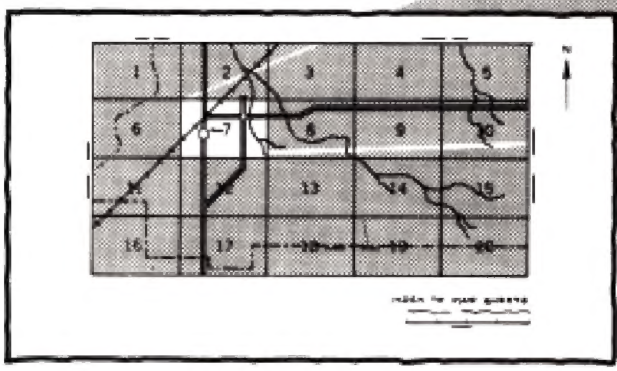
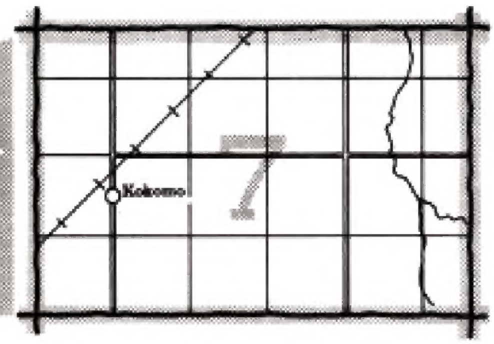
soil survey of
Jim Wells County, Texas

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

HOW TO USE

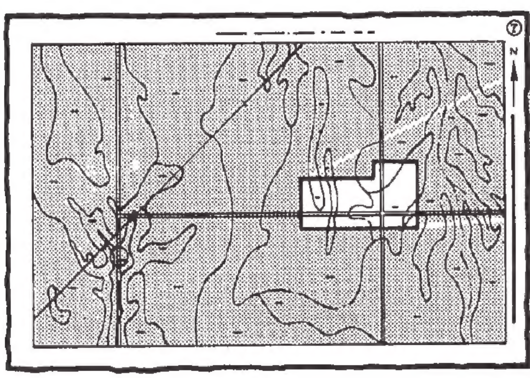
1. Locate your area of interest on the "Index to Map Sheets"

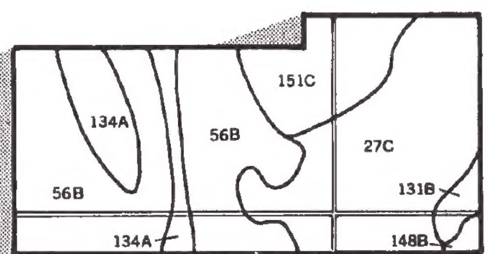




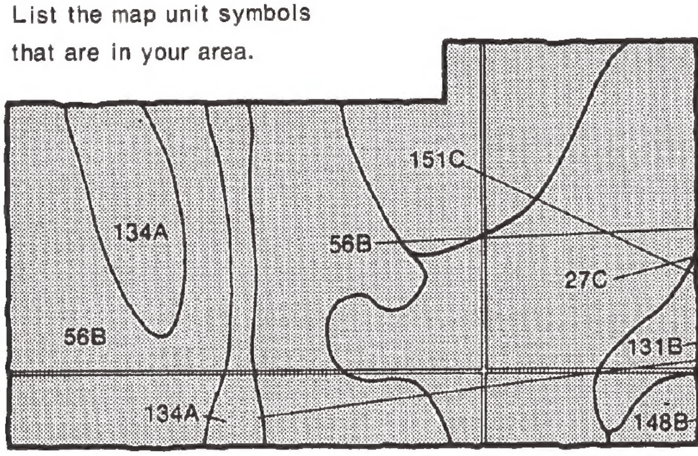
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area.

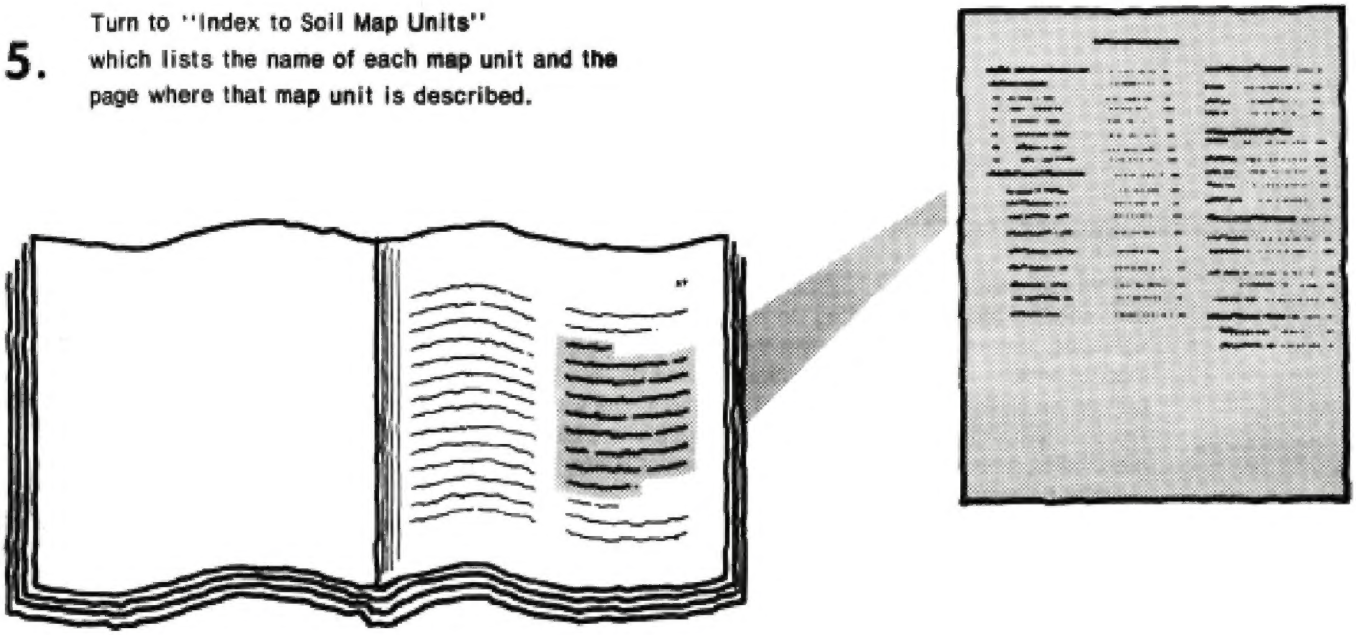


Symbols

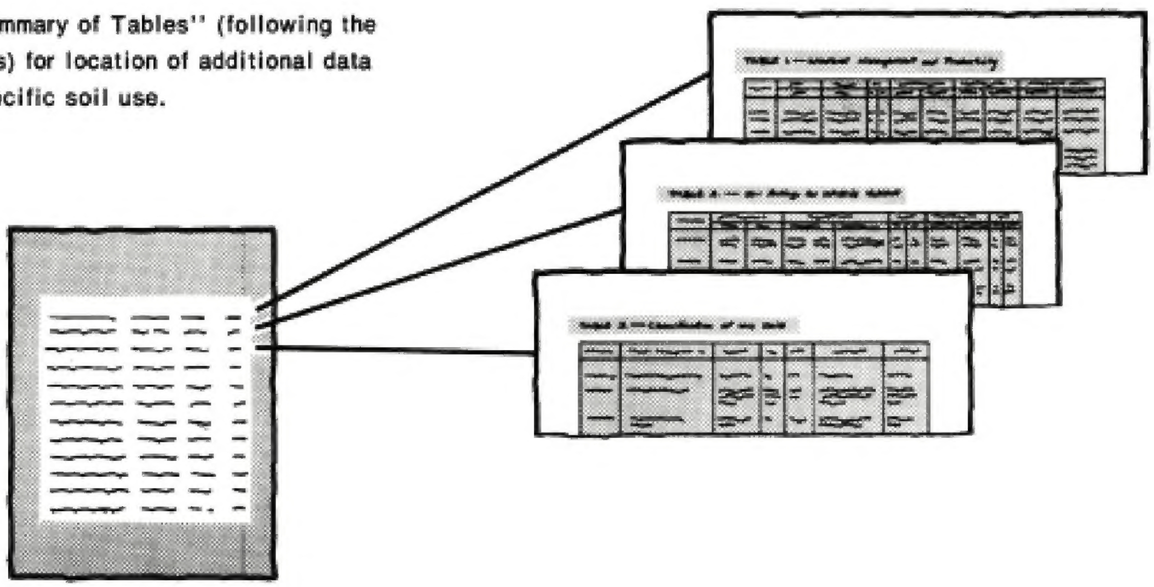
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1974. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Nueces-Jim Wells-Kleberg Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Clareville loam, 0 to 1 percent slopes, is well suited to grain sorghum.

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Issued November 1979

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Summary of tables

Foreword

This soil survey contains much information useful in land-planning programs in Jim Wells County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks

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State Conservationist
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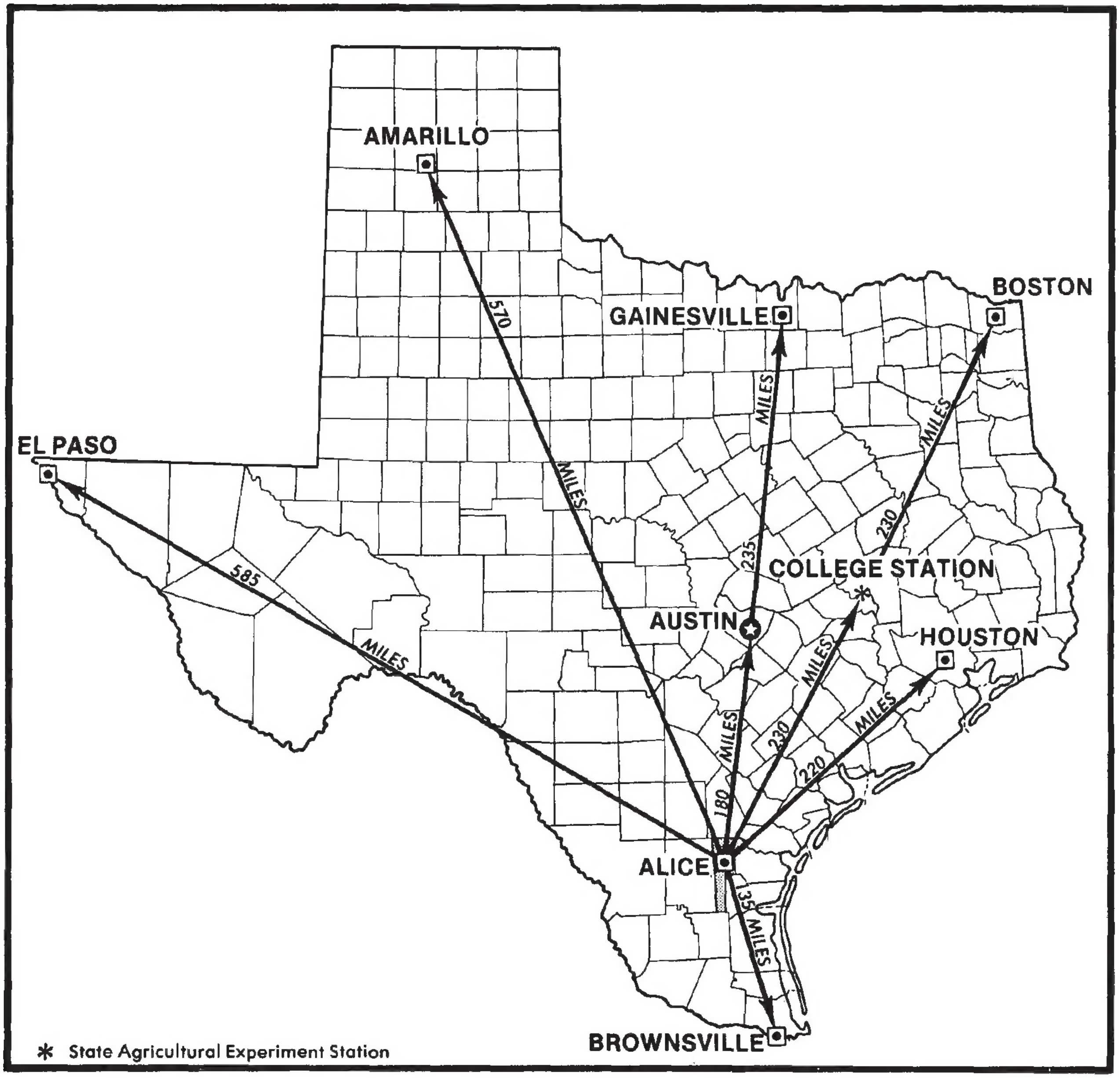

Location of Jim Wells County in Texas.

SOIL SURVEY OF JIM WELLS COUNTY, TEXAS

By Fred E. Minzenmayer, Soil Conservation Service

Soils surveyed by Larry F. Ratliff, Guido Franki, Dan Arriaga, Ramon Garcia, Ben Hajek, Russell Sanders, and Charles M. Thompson, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with Texas Agricultural Experiment Station

JIM WELLS COUNTY is in the southern part of Texas. It covers an area of 542,080 acres, or 847 square miles, of which 1,216 acres is water. Elevation ranges from 100 to 400 feet above sea level. The average annual rainfall is 26.6 inches, mean annual temperature is 72.4 degrees F, and the growing season is 289 days.

Ranching and farming and oil and gas production are important enterprises in the county. About 75 percent of the county, mostly the western and southwestern parts, is nearly level to sloping rangeland and pastureland. About 22 percent, the northern and northeastern parts, is nearly level to gently sloping cropland and pastureland. The rest is urban land and water areas. The main ranching enterprise is raising beef cattle. The main cultivated crops are cotton, grain sorghum, and flax.

The soils of this county formed under grass vegetation and are dominantly dark colored, loamy, and dry. Areas that are not protected are subject to water erosion.

General nature of the county

This section briefly discusses settlement and population, climate, agriculture, natural resources, and geology.

Settlement and population

Jim Wells County was established in 1911. It was named after Judge James B. Wells, a lawyer and political figure of the Fifteenth Congressional District (*5*).

The area was settled in 1748. The settlers were cattlemen from the hills of Andalucia and the semiarid regions of northern Mexico. Many of the cattlemen received their land from grants directly from the King of Spain.

One grant of about 886,000 acres to Enrique Villareal in June 1785 included the territory that later was divided into Nueces and Jim Wells Counties. In 1832, Captain H.L. Kinney bought part of this grant and brought settlers from Europe.

In 1970, the population of the county was 33,032. Alice, the county seat, is in the center of the county and has a population of 20,121 (*3*).

Climate

Jim Wells County has hot summers and fairly warm winters. Cold spells or snowfalls are rare. Rains are usually heaviest late in spring and early in fall. Rain in the fall is often associated with a dissipating tropical storm. Total annual precipitation is usually adequate for range vegetation. But, because of the high rate of evapotranspiration, it often is not adequate for cotton, small grain, and sorghum without supplemental irrigation.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Alice, Texas, for the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 58 degrees F, and the average daily minimum temperature is 45 degrees. The lowest temperature on record, which occurred at Alice on January 12, 1962, is 12 degrees. In summer the average temperature is 84 degrees, and the average daily maximum temperature is 96 degrees. The highest recorded temperature, which occurred on August 8, 1956, is 110 degrees. Freeze dates in spring and fall are given in table 2.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 19 inches, or 70 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than

13 inches. The heaviest 1-day rainfall during the period of record was 13.21 inches at Alice on September 13, 1951. Thunderstorms occur on about 30 days each year, and most occur in summer.

Snowfall is rare; in 95 percent of the winters there is no measureable snowfall. In 5 percent, the snowfall is usually of short duration and totals more than 4 inches. The heaviest 1-day snowfall on record was more than 4 inches.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The percentage of possible sunshine is 80 in summer and 50 in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 15 miles per hour, in April.

This information on the climate of Jim Wells County was prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Agriculture

The first settlers in Jim Wells County were mainly cattle ranchers. After the Civil War, when cattle prices were high, the range was overstocked and stands of desirable grasses were destroyed. When prices fell, many of the ranches were divided into smaller units or were sold to cotton farmers (*4*).

After cotton was established as a major crop, shallow, rolling soils began to erode, and rich, level soils were depleted. Because of continuous row cropping, the content of organic matter decreased, lowering the available water holding capacity of the soil. In addition, plant diseases and insect pests increased.

The enactment of the Soil Conservation District legislation in 1937 gave the landowners of Jim Wells County the legal authority to vote themselves into a locally organized conservation district. In December 1941, the San Diego-Aqua Dulce Soil and Water Conservation District was organized, and in March 1967, the District was renamed the Nueces-Jim Wells-Kleberg Soil and Water Conservation District.

Cotton, grain sorghum, flax, and beef cattle are the main agricultural products. These products and dairy cattle, hogs, poultry, and vegetables represent an annual farm income of about 16 million dollars.

Natural resources

Soil is the most important natural resource in the county. Oil and gas are also important resources. The first major oil field was brought into production in 1936 (*5*). As a result, the population of the county and of Alice increased. The county was regarded as the center of the South Texas oil field servicing business. At one time 55 companies or producers were operating in the county.

Geology

The soils in Jim Wells County developed from parent material of four geologic formations: the Lagarto Clay, Goliad, Lissie, and Beaumont Formations. (*6*). The Lagarto Clay Formation is a member of the Fleming Group of Miocene Age, the Goliad Formation is a member of the Citronelle Group of Pliocene Age, and the Lissie and Beaumont Formations make up the Houston Group of Pleistocene Age. These formations cross the county in a general northeast to southwest direction. Floodwaters from rivers may have deposited the sediments that make up each formation mostly in the form of natural levees and deltas. The shifting of river mouths and channels combined these levees and deltas. These deltaic deposits are interbedded in places with marine and lagoonal beds, which were covered by the shifting river mouths. Because of differences in time, source of material, and variation in velocity of floodwaters, the type and size of sediments varies among the different geologic formations.

The surface of the Lagarto Clay Formation is characterized locally as level to gently rolling, maturely dissected uplands that are crossed by broad valleys. This formation outcrops along the Lagarto Creek. Typically, the Lagarto Clay Formation is made up of 75 percent marl, 15 percent sand, and 10 percent silt. The clay is massive, yellow or gray, and calcareous; in places it has many concretions of calcium carbonate. The sand is variable in color and is mainly composed of quartz. The sediments of the Lagarto Clay Formation may have been deposited when rivers were near base level and carrying fine sediments of Cretaceous Age.

The surface of the Goliad Formation is characterized by maturely dissected rolling uplands that have been eroded into resistant ridges and valleys. The outcrop of the formation covers a belt about 15 miles wide and has an average thickness of about 250 feet. The stratigraphy and lithology of the Goliad Formation is described as variable because of the difficulty in distinguishing this formation from the overlying and underlying formations. In an outcrop in Live Oak County, Texas, the Goliad Formation is a clay zone consisting of pinkish brown and reddish mottled limy clays. In other places in South Texas, layers of the Goliad Formation have calcium carbonate in the form of concretions, nodules, and hard nodular limestone. Typically, the Goliad Formation consists of about 80 percent sand, 5 percent gravel, 10 percent clay, and 5 percent calcium carbonate. In South Texas, the sand and gravel are impregnated with much calcium carbonate. The sand is made up mostly of quartz, but there are large amounts of feldspar. The sediments were probably laid down during alternating cycles of floods and drought. The Goliad Formation lies unconformably to the northwest over the Lagarto Clay formation.

The surface of the Lissie Formation is characterized by a flat, nearly level to gently undulating plain. Streams meander across the plain in shallow valleys and have fringes of trees along their courses. The formation is about 200 feet thick and outcrops in a belt about 30 miles wide parallel to the coastal plain at a distance of about 50 miles from the coast. Typically, the Lissie Formation consists of about 60 percent sand, 20 percent sandy clay, 10 percent clay, and 10 percent gravel. The sand is made up mostly of quartz and chert grains. The deposits probably began during the Glacial Epoch and were laid down by violent flooding. The Lissie Formation lies unconformably to the northwest over the Goliad Formation.

The surface of the Beaumont Formation is characterized by a flat, treeless plain that is not cut by broad valleys. The formation is 450 to 900 feet thick but averages about 700 feet. Typically, the Beaumont Formation consists of 80 to 90 percent clay, 10 percent sand, and 10 percent silt. The clay is colloidal, calcareous, and variable in color. The sand is made up mostly of quartz and chert grains. Some feldspars are in this formation in the South Texas area. The Beaumont Formation lies unconformably to the northwest over the Lissie Formation.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After classifying and naming the soils, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil. Map units are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows map units that have a distinct pattern of soils, relief, and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscape in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map and gives general ratings of the potential of each, in relation to the

other map units, for major land uses. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for cultivated farm crops, rangeland, urban uses, and recreation uses. Cultivated farm crops are those grown extensively by farmers in the survey area, for example, cotton, grain sorghum, and flax. Rangeland refers to land on which the native vegetation is used for grazing. Urban uses include residential, commercial, and industrial developments. Recreation areas include campsites, picnic areas, ballfields, and those areas used for nature study and as wilderness.

In general, the kinds of soils, low rainfall, and lack of irrigation water are the most important factors that influence land use in Jim Wells County.

About 56 percent of the county is used as rangeland, and about 40 percent is used for cultivated farm crops and improved pastures. The rest is urban land, federal land, and small water areas. Table 4 shows that about 34 percent of the county has high potential for rangeland and 66 percent has medium potential. About 17 percent of the county has high potential for cultivated farm crops, 82 percent has medium potential, and 1 percent has low potential.

The Runge-Delfina-Papalote map unit generally has high potential for cultivated farm crops. The soils in this map unit are deep and loamy and are well suited to cultivation, but they need good management practices to prevent water erosion. The Runge-Delfina-Papalote, Opelika-Delfina-Czar, and Aransas-Sinton map units have high potential for rangeland. The soils in these map units are deep and loamy and sandy. They need careful management to prevent water erosion. None of the map units has high potential for urban uses, but the deep, loamy soils in many of the map units are highly favorable. Careful management is needed to prevent water erosion especially during and immediately following construction. The main problems are shrinking and swelling, corrosivity to uncoated steel, seepage, slow percolation, and low strength. The Goliad-Parrita-Lacoste and Papalote-Czar map units have high potential for recreation uses.

Deep, nearly level to gently sloping, clayey and loamy soils on uplands

The soils in this group make up about 26 percent of the county. The major soils are Lattas, Opelika, and Clareville soils. The surface layer and underlying layers of these soils are loamy or clayey. These soils are well drained or somewhat poorly drained and are very slowly permeable or moderately slowly permeable.

Most areas of these soils are used for cultivated crops. Cotton, grain sorghum, and flax are the main cultivated crops. A few areas are in improved pasture of coastal bermudagrass.

The soils in this group have low potential for urban and recreation uses.

1. Lattas-Opelika-Clareville

Somewhat poorly drained and well drained, very slowly permeable and moderately slowly permeable, clayey and loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 23 percent of the county. It is about 40 percent Lattas soils, 20 percent Opelika soils, 18 percent Clareville soils, and 22 percent minor soils (fig. 1).

Lattas soils have a surface layer that is firm, moderately alkaline, dark gray clay about 5 inches thick. Below that, to a depth of 21 inches, the soil is very firm, moderately alkaline, very dark gray clay. To a depth of 29 inches, it is very firm, moderately alkaline, dark gray clay that has a few slickensides. Below that, to a depth of 53 inches, the soil is very firm, moderately alkaline, gray clay that has a few slickensides and a few old cracks that are filled with dark gray material. The underlying material, to a depth of 70 inches, is very firm, moderately alkaline, light brownish gray clay that has a few old cracks filled with dark gray material.

Opelika soils have a surface layer that is about 4 inches thick. The layer is friable, neutral, gray fine sandy loam. Below that, to a depth of 10 inches, the soil is firm, mildly alkaline, dark gray sandy clay. To a depth of 19 inches, it is firm, moderately alkaline, dark gray sandy clay loam. Below that, to a depth of 30 inches, the soil is friable, moderately alkaline, gray sandy clay loam that has streaks of light brownish gray material. And to a depth of 60 inches, the soil is friable, moderately alkaline, light gray sandy clay loam that has yellowish mottles.

Clareville soils have a surface layer that is about 11 inches thick. The layer is friable, neutral, dark gray loam in the upper 5 inches and friable, neutral, very dark gray clay loam in the lower 6 inches. Below that, to a depth of 18 inches, the soil is firm, mildly alkaline, very dark gray clay loam. To a depth of 25 inches, it is firm, mildly alkaline, dark grayish brown clay loam. Below that, to a depth of 33 inches, the soil is very firm, moderately alkaline, brown clay loam. To a depth of 38 inches, it is very firm, moderately alkaline, grayish brown clay loam. Below that, to a depth of 46 inches, the soil is firm, moderately alkaline, grayish brown clay loam that is about 20 percent, by volume, soft masses and concretions of calcium carbonate. And to a depth of 64 inches, the soil is friable, moderately alkaline, very pale brown loam.

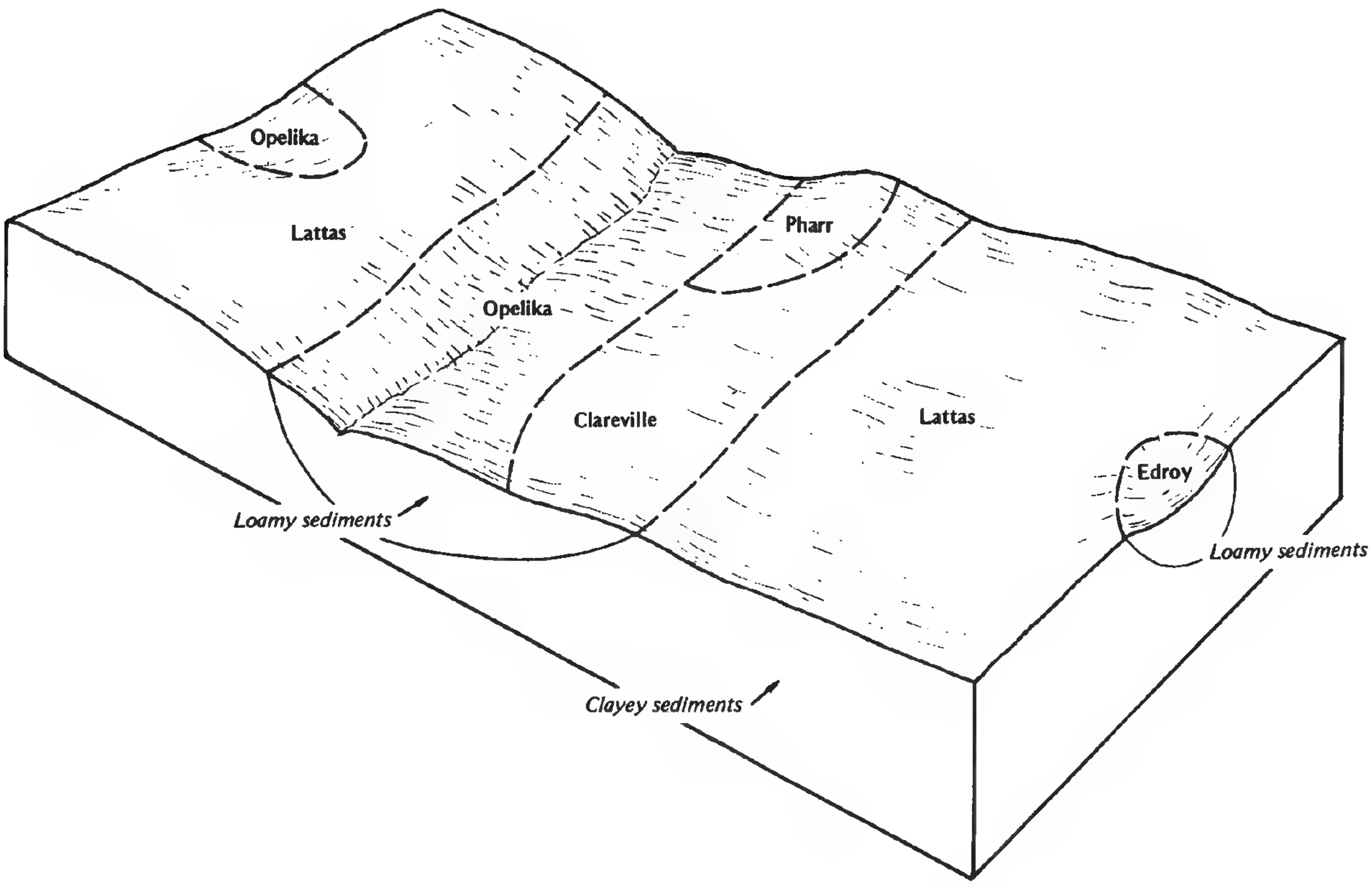

Figure 1.—Typical pattern of soils in Lattas-Opelika-Clareville map unit.

The minor soils included in the map unit are the Aransas, Czar, Edroy, and Pharr soils. The deep, clayey, nearly level Aransas soils are on bottom lands. The deep, loamy, nearly level to gently sloping Czar soils are on uplands. The deep, clayey, nearly level Edroy soils are on uplands or terraces and depressions. The deep, loamy, nearly level to gently sloping Pharr soils are on deltas or coastal terraces.

Most areas of this map unit are used as cropland, but some areas are used for improved pasture and as rangeland.

The potential for cultivated crops is high. Low rainfall is the main limitation. Cotton, grain sorghum, and flax are the main crops.

The potential for rangeland is high. Native range plants are mainly mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and moderately slow permeability, the potential for most urban uses is low.

2. Lattas

Somewhat poorly drained, very slowly permeable, clayey soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 3 percent of the county. It is about 75 percent Lattas soils and 25 percent minor soils.

Lattas soils have a surface layer that is firm, moderately alkaline, dark gray clay about 5 inches thick. The layer below that, to a depth of 21 inches, is very firm, moderately alkaline, very dark gray clay. Below that, to a depth of 29 inches, the soil is very firm, moderately alkaline, dark gray clay that has a few slickensides. To a

depth of 53 inches, the soil is very firm, moderately alkaline, gray clay that has a few slickensides and a few old cracks filled with dark gray material. The underlying material, to a depth of 70 inches, is very firm, moderately alkaline, light brownish gray clay that has a few old cracks filled with dark gray material.

The minor soils included in this map unit are the Clareville and Opelika soils. The deep, loamy, nearly level Clareville soils are on uplands. The deep, loamy, nearly level Opelika soils are in slightly concave, weakly expressed drainageways and on low terraces on uplands adjacent to the drainageways.

Most areas of this map unit are used as cropland.

The potential for cultivated crops is high. Low rainfall is the main limitation. Cotton, grain sorghum, and flax are the main crops.

The potential for rangeland use is medium. Native range plants are mainly mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and very slow permeability, the potential for most urban uses is low.

Deep to shallow, nearly level to gently sloping, loamy soils on uplands

The soils in this group make up about 28 percent of the county. The major soils are Pernitas, Olmos, Pettus, Goliad, Parrita, and Lacoste soils. The surface layer of these soils is loamy, and the underlying layers are loamy or clayey. These soils are well drained or moderately well drained and are moderately permeable or moderately slowly permeable.

Most areas of these soils are used as rangeland. The native plants are trichloris, bluestem, grama, bristlegrass, windmillgrass, witchgrass, cottontop, and switchgrass and mesquite trees and other woody species.

The soils in this group have medium potential for urban uses and medium or high potential for recreation uses.

3. Pernitas-Olmos-Pettus

Well drained, moderately permeable, loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 5 percent. It makes up about 20 percent of the county. It is about 38 percent Pernitas soils, 13 percent Olmos soils, 7 percent Pettus soils, and 42 percent minor soils (fig. 2).

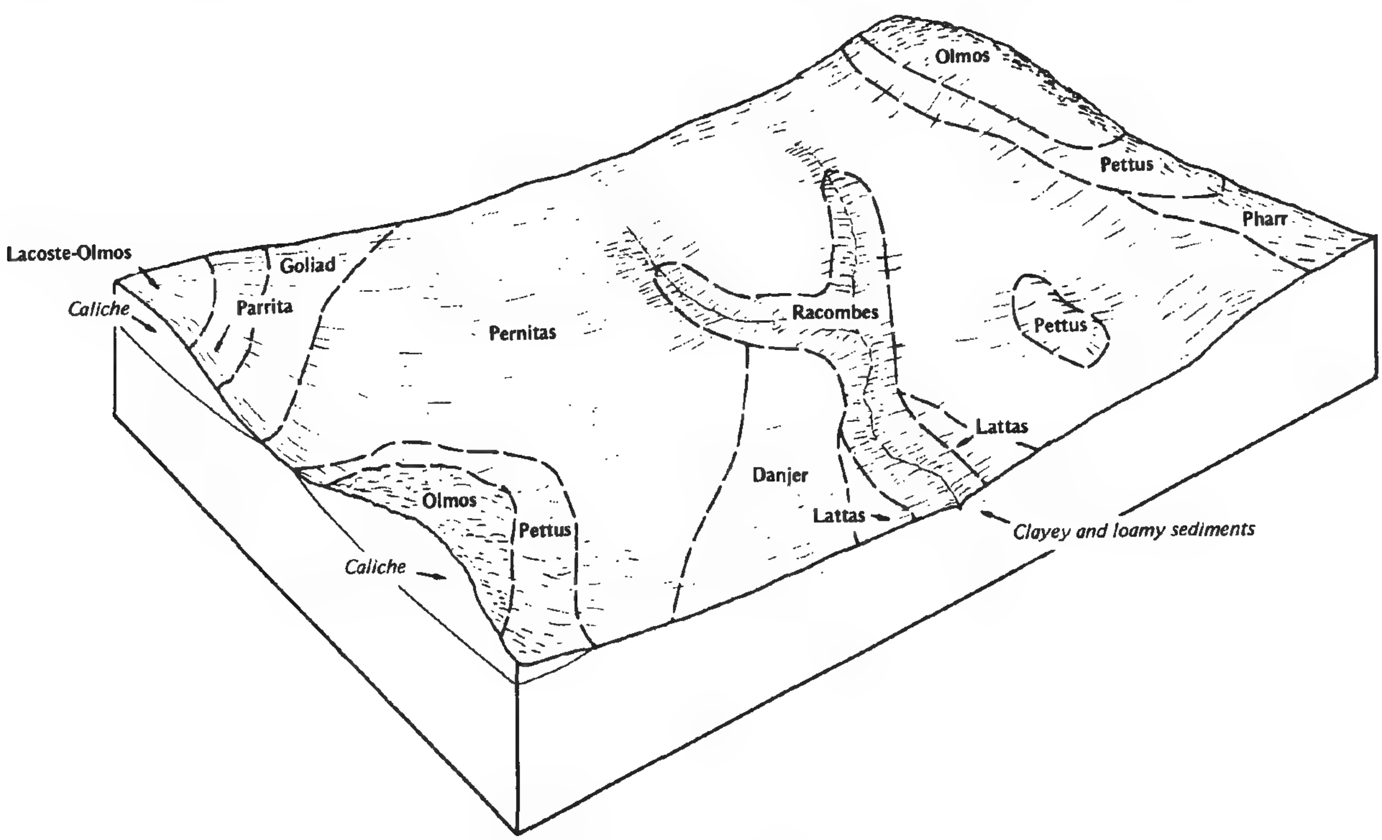

Figure 2.—Typical pattern of soils in Pernitas-Olmos-Pettus map unit.

Pernitas soils have a surface layer that is about 11 inches thick. The layer is friable, moderately alkaline, dark gray sandy clay loam. Below that, to a depth of 30 inches, the soil is friable, moderately alkaline clay loam that is grayish brown in the upper 6 inches and brown in the lower 13 inches. To a depth of 72 inches, the soil is friable, moderately alkaline clay loam. It is light brown and 20 to 25 percent, by volume, soft masses and concretions of calcium carbonate in the upper 6 inches and pinkish gray and 15 to 20 percent, by volume, soft masses of calcium carbonate in the lower 36 inches.

Olmos soils have a surface layer that is about 9 inches thick. The layer is friable, moderately alkaline, grayish brown gravelly loam. In the upper 3 inches, it is about 3 to 5 percent concretions and fragments of calcium carbonate, mostly less than 5 millimeters wide, and about 20 percent caliche fragments. In the lower 6 inches, it is about 5 to 10 percent concretions and fragments of calcium carbonate, mostly less than 1 centimeter wide, and about 30 percent caliche fragments. The underlying material, in the upper 4 inches, is white and pink, strongly cemented, laminar caliche that has solution channels filled with gray and dark gray material; below that, it is white, weakly cemented, nodular caliche that has interstices filled with light brownish gray loamy material.

Pettus soils have a surface layer that is about 10 inches thick. The layer is very friable, moderately alkaline, grayish brown sandy clay loam. The layer below that, to a depth of 17 inches, is friable, moderately alkaline, light brownish gray sandy clay loam. Next, to a depth of 21 inches, the soil is white, weakly cemented, platy and fractured caliche that has interstices, root channels, and solution channels filled with light brownish gray sandy clay loam material. Below that, to a depth of 65 inches, the soil is white, gravelly sandy clay loam that is about 60 percent soft masses and nodular concretions of calcium carbonate up to 2 centimeters wide.

The minor soils are the Danjer, Goliad, Lacoste, Lattas, Opelika, Parrita, Pettus, Pharr, Racombes, and Runge soils. The deep, clayey, nearly level to gently sloping Danjer soils are on uplands. The moderately deep, loamy, nearly level to gently sloping Goliad soils are on uplands. The shallow, loamy, nearly level to gently sloping Lacoste and Pettus soils are on uplands. The deep, clayey, nearly level to gently sloping Lattas soils are on uplands. The deep, loamy, nearly level Opelika soils are in slightly concave, weakly expressed drainageways and on low terraces on uplands adjacent to the drainageways. The shallow, loamy, nearly level to gently sloping Parrita soils are on upland ridgetops and upper side slopes. The deep, loamy, nearly level to gently sloping Pharr soils are on deltas or coastal terraces. The deep, loamy, nearly level Racombes soils are on deltaic or coastal terraces. The deep, loamy, nearly level to gently sloping Runge soils are on uplands and stream terraces.

Most areas of this map unit are used as rangeland, but some areas are cultivated.

The potential for cultivated crops is medium. Low rainfall and the hazard of water erosion are the main limitations. Grain sorghum is the main crop.

The potential for rangeland is medium. Native range plants are mainly short and mid grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, cemented pan, and seepage, the potential for most urban uses is medium.

4. Goliad-Parrita-Lacoste

Moderately well drained and well drained, moderately slowly permeable and moderately permeable, loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 5 percent. It makes up about 8 percent of the county. It is about 35 percent Goliad soils, 33 percent Parrita soils, 12 percent Lacoste soils, and 20 percent minor soils.

Goliad soils have a surface layer that is about 11 inches thick. The layer is friable, mildly alkaline, very dark grayish brown sandy clay loam. Below that, to a depth of 15 inches, the soil is friable, moderately alkaline, brown sandy clay. To a depth of 28 inches, it is firm, moderately alkaline, reddish brown clay. The underlying material consists of white and pinkish white indurated caliche.

Parrita soils have a surface layer that is about 5 inches thick. The layer is friable, mildly alkaline, dark brown sandy clay loam. The layer below that extends to a depth of 17 inches. It is firm, moderately alkaline, dark reddish brown sandy clay loam in the upper 4 inches and very firm, moderately alkaline, reddish brown clay in the lower 8 inches. The underlying material consists of white and pinkish white, strongly cemented and laminar caliche that has a few fine fractures.

Lacoste soils have a surface layer about 7 inches thick. The layer is very friable, mildly alkaline, brown fine sandy loam in the upper 2 inches and friable, moderately alkaline, brown fine sandy loam in the lower 5 inches. Below that, to a depth of 12 inches, the soil is friable, moderately alkaline, reddish brown sandy clay loam. The underlying material is white, strongly cemented caliche that is fractured in the upper part.

The minor soils in this map unit are the Delfina, Olmos, Papagua, Papalote, and Runge soils. The deep, loamy, nearly level to gently sloping Delfina soils are on uplands and old stream terraces. The shallow, loamy, undulating Olmos soils are on uplands. The deep, sandy, nearly level Papagua soils are on slightly concave and weakly depressional drainage terraces. The deep, loamy, nearly level to gently sloping Papalote soils are on stream terraces and upland plains. The deep, loamy, nearly level to gently sloping Runge soils are on uplands and stream terraces.

Most areas of this map unit are used as rangeland and improved pastures, but some areas are cultivated.

The potential for cultivated crops is medium. Low rainfall, the hazard of water erosion, and a cemented pan are the main limitations. Grain sorghum is the main crop.

The potential for rangeland use is medium. Native range plants are short, mid, and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, cemented pan, and moderate and moderately slow permeability, the potential for most urban uses is medium.

Deep, nearly level to gently sloping, loamy and sandy soils on uplands

The soils in this group make up about 45 percent of the county. The main soils are Runge, Delfina, Papalote, Opelika, Czar, and Papagua soils.

The surface layer of these soils is sandy or loamy, and the underlying layers are loamy or clayey. The soils are well drained to somewhat poorly drained and are moderately permeable to very slowly permeable.

Most areas of these soils are used for cultivated crops and improved pasture. Cotton, grain sorghum, and flax are the main cultivated crops. Improved pastures consist of coastal bermudagrass and buffelgrass.

The soils in this group have medium potential for urban uses and medium or high potential for recreation uses.

5. Runge-Delfina-Papalote

Well drained and moderately well drained, moderately permeable to slowly permeable, loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 5 percent. It makes up about 17 percent of the county. It is about 37 percent Runge soils, 28 percent Delfina soils, 8 percent Papalote soils, and 27 percent minor soils (fig. 3).

Runge soils have a surface layer that is about 14 inches thick. The layer is very friable, neutral, brown fine

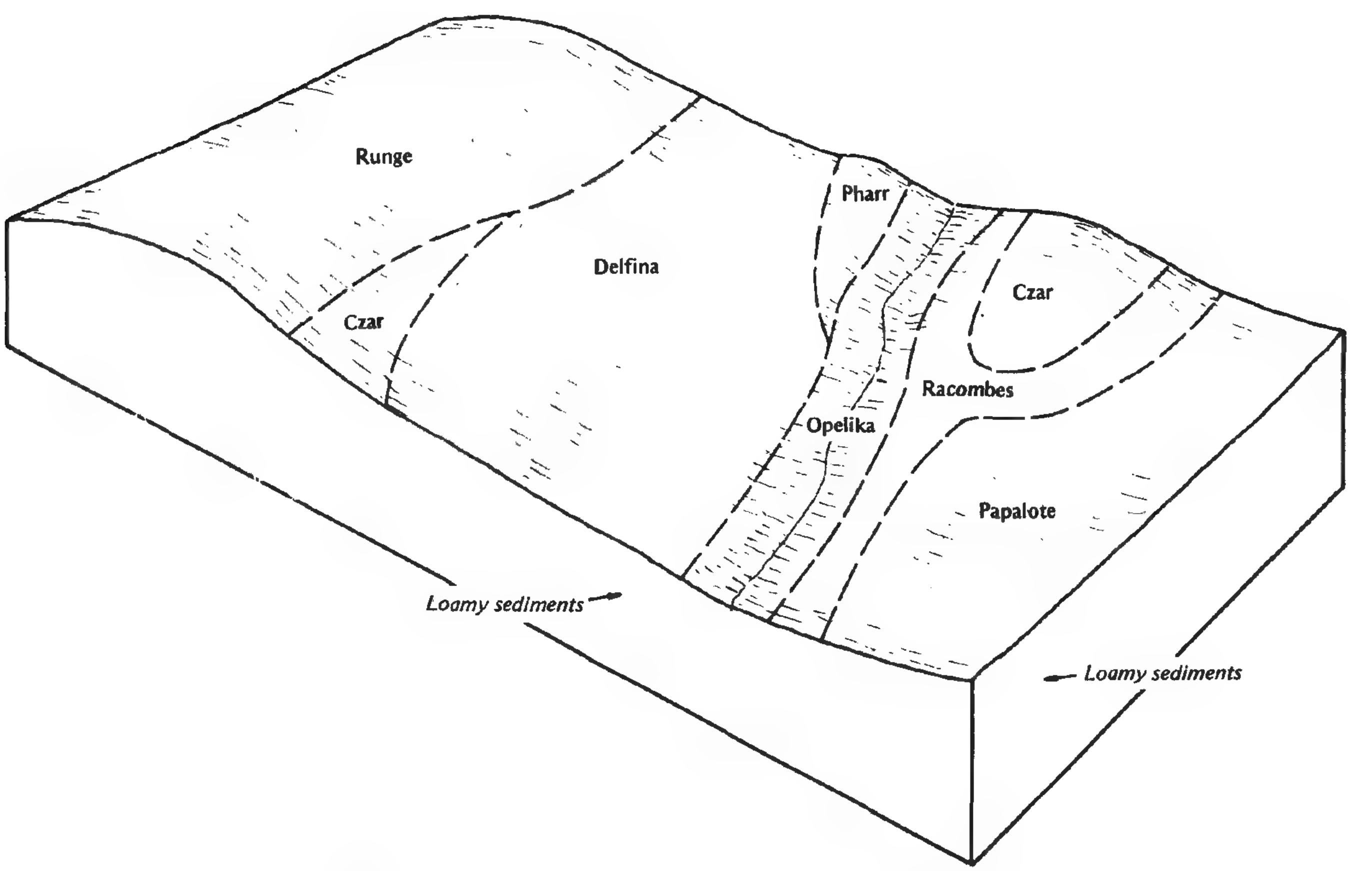

Figure 3.—Typical pattern of soils in Runge-Delfina-Papalote map unit.

sandy loam. Below that, to a depth of 18 inches, the soil is friable, neutral, reddish brown sandy clay loam. To a depth of 34 inches, it is friable, mildly alkaline, yellowish red sandy clay loam. Below that, to a depth of 55 inches, it is friable, moderately alkaline, reddish yellow sandy clay loam. And to a depth of 72 inches, the soil is friable, moderately alkaline, reddish yellow sandy clay loam that is about 5 percent, by volume, soft masses and concretions of calcium carbonate.

Delfina soils have a surface layer that is about 12 inches thick. The layer is very friable, slightly acid, brown fine sandy loam. Below that, to a depth of 16 inches, the soil is firm, neutral, brown sandy clay loam. To a depth of 28 inches, it is very firm, mildly alkaline, brown sandy clay loam that is mottled in shades of red, yellow, and gray. Below that, to a depth of 36 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 80 inches, the soil is firm, moderately alkaline, reddish yellow sandy clay loam that is about 4 percent, by volume, soft masses and concretions of calcium carbonate.

Papalote soils have a surface layer that is about 16 inches thick. The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 20 inches, the soil is very firm, mildly alkaline, brown sandy clay that is mottled in shades of red and gray. To a depth of 31 inches, it is very firm, moderately alkaline, brown sandy clay that has mottles in shades of red and brown. Below that, to a depth of 38 inches, the soil is very firm, moderately alkaline, light brown sandy clay. To a depth of 49 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 65 inches, the soil is firm, moderately alkaline, pink sandy clay loam that is about 2 to 4 percent, by volume, soft masses of calcium carbonate.

The minor soils in the map unit are the Czar, Delmita, Edroy, Goliad, Lacoste, Opelika, Papagua, Pharr, and Racombes soils. The deep, loamy, nearly level to gently sloping Czar soils are on uplands. The moderately deep, loamy, gently sloping Delmita soils are on upland plains. The deep, clayey, nearly level Edroy soils are on uplands or terraces and in depressions. The moderately deep, loamy, nearly level to gently sloping Goliad soils are on uplands. The shallow, loamy, nearly level to gently sloping Lacoste soils are on uplands. The deep, loamy, nearly level Opelika soils are in slightly concave, weakly expressed drainageways and on low terraces on uplands adjacent to the drainageways. The deep, sandy, nearly level Papagua soils are on slightly concave and weakly depressional drainage terraces. The deep, loamy, nearly level to gently sloping Pharr soils are on deltas or coastal terraces. The deep, loamy, nearly level Racombes soils are on deltaic or coastal terraces.

Most areas of this map unit are used as cropland and improved pasture.

The potential for cultivated crops is high. Grain sorghum, cotton, and flax are the main crops.

The potential for rangeland is high. Native range plants are mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and moderate to slow permeability, the potential for most urban uses is medium.

6. Opelika-Delfina-Czar

Somewhat poorly drained to well drained, very slowly permeable to moderately permeable, loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 16 percent of the county. It is about 50 percent Opelika soils, 17 percent Delfina soils, 16 percent Czar soils, and 17 percent minor soils.

Opelika soils have a surface layer that is about 4 inches thick. The layer is friable, neutral, gray fine sandy loam. Below that, to a depth of 10 inches, the soil is firm, mildly alkaline, dark gray sandy clay. To a depth of 19 inches, it is friable, moderately alkaline, gray sandy clay loam that has streaks of light brownish gray material. Below that, to a depth of 60 inches, the soil is friable, moderately alkaline, light gray sandy clay loam that has yellowish mottles.

Delfina soils have a surface layer that is about 12 inches thick. The layer is very friable, slightly acid, brown fine sandy loam. Below that, to a depth of 16 inches, the soil is firm, neutral, brown sandy clay loam. To a depth of 28 inches, it is very firm, mildly alkaline, brown sandy clay loam that is mottled in shades of red, yellow, and gray. Below that, to a depth of 36 inches, the soil is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 80 inches, the soil is firm, moderately alkaline, reddish yellow sandy clay loam that is about 4 percent, by volume, soft masses and concretions of calcium carbonate.

Czar soils have a surface layer that is about 13 inches thick. The layer is friable, neutral, dark grayish brown fine sandy loam. The layer below that, to a depth of 34 inches, is friable, moderately alkaline, dark brown sandy clay loam in the upper 9 inches and firm, moderately alkaline, brown sandy clay loam in the lower 12 inches. Below that, to a depth of 47 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam. And to a depth of 68 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam.

The minor soils in the map unit are the Clareville, Edroy, Papagua, Papalote, Racombes, and Runge soils. The deep, loamy, nearly level Clareville soils are on level uplands. The deep, clayey, nearly level Edroy soils are on uplands or terraces and in depressions. The deep, sandy, nearly level Papagua soils are on slightly concave and weakly depressional drainage terraces. The deep, loamy, nearly level to gently sloping Papalote soils are on stream terraces and upland plains. The deep, loamy, nearly level Racombes soils are on deltaic or coastal

terraces. The deep, loamy, nearly level to gently sloping Runge soils are on uplands and stream terraces.

Most areas of this map unit are used as cropland and improved pasture.

The potential for cultivated crops is medium. Low rainfall and the hazard of water erosion are the main limitations. Grain sorghum, cotton, and flax are the main crops.

The potential for rangeland is high. Native range plants are mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, wetness, and very slow to moderate permeability, the potential for most urban uses is medium.

7. Delfina-Papagua-Papalote

Moderately well drained and somewhat poorly drained, moderately slowly permeable to slowly permeable, sandy and loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 9 percent of the county. It is about 33 percent Delfina soils, 31 percent Papagua soils, 18 percent Papalote soils, and 18 percent minor soils.

Delfina soils have a surface layer that is about 12 inches thick. The layer is very friable, slightly acid, brown fine sandy loam. Below that layer, to a depth of 16 inches, the soil is firm, neutral, brown sandy clay loam. Below that, to a depth of 28 inches, it is very firm, mildly alkaline, brown sandy clay loam that is mottled in shades of red, yellow, and gray. To a depth of 36 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 80 inches, the soil is firm, moderately alkaline, reddish yellow sandy clay loam that is about 4 percent, by volume, soft masses and concretions of calcium carbonate.

Papagua soils have a surface layer that is about 16 inches thick. The layer is very friable, neutral, light brownish gray loamy fine sand. Below that layer, to a depth of 30 inches, the soil is firm, neutral, light brownish gray sandy clay that is mottled in shades of yellow and brown. To a depth of 46 inches, it is firm, neutral, light brownish gray sandy clay loam that has brown and gray mottles. Below that, to a depth of 57 inches, it is firm, moderately alkaline, light brownish gray sandy clay loam. And to a depth of 65 inches, the soil is firm, moderately alkaline, very pale brown sandy clay loam.

Papalote soils have a surface layer that is about 16 inches thick. The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 20 inches, the soil is very firm, mildly alkaline, brown sandy clay that is mottled in shades of red and gray. The layer below that, to a depth of 31 inches, is very firm, moderately alkaline, brown sandy clay that has mottles in shades of red and brown. To a depth of 38 inches, the soil is very firm, moderately alkaline, light brown sandy clay. To a depth of 49 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 65 inches, the soil is firm, moderately alkaline, pink sandy clay loam that is about 2 to 4 percent, by volume, soft masses of calcium carbonate.

The minor soils included in this map unit are the Comitas, Czar, Edroy, Leming, and Opelika soils. The deep, sandy, nearly level to gently sloping Comitas soils are on uplands and terraces. The deep, loamy, nearly level to gently sloping Czar soils are on uplands. The deep, clayey, nearly level Edroy soils are on uplands or terraces and in depressions. The deep, sandy, nearly level to gently sloping Leming soils are on uplands. The deep, loamy, nearly level Opelika soils are in slightly concave, weakly expressed drainageways and on nearly level low terraces on uplands adjacent to the drainageways.

Most areas of this map unit are used as cropland and improved pasture.

The potential for cultivated crops is medium. Low rainfall and the hazard of water erosion are the main limitations. Grain sorghum, cotton, and flax are the main crops.

The potential for rangeland is medium. Native range plants are mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and moderately slow to slow permeability, the potential for most urban uses is medium.

8. Papalote-Czar

Moderately well drained and well drained, slowly permeable and moderately permeable, sandy and loamy soils

This map unit consists of nearly level to gently sloping soils that have slopes of 0 to 3 percent. It makes up about 3 percent of the county. It is about 42 percent Papalote soils, 35 percent Czar soils, and 23 percent minor soils.

Papalote soils have a surface layer that is about 16 inches thick. The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 20 inches, the soil is very firm, mildly alkaline, brown sandy clay that is mottled in shades of red and gray. The layer below that, to a depth of 31 inches, is very firm, moderately alkaline, brown sandy clay that has mottles in shades of red and brown. To a depth of 38 inches, the soil is very firm, moderately alkaline, light brown sandy clay. Below that, to a depth of 49 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 65 inches, the soil is firm, moderately alkaline, pink sandy clay loam that is about 2 to 4 percent, by volume, soft masses of calcium carbonate.

Czar soils have a surface layer about 13 inches thick. The layer is friable, neutral, dark grayish brown fine sandy loam. The layer below that, to a depth of 34 inches, is friable, moderately alkaline, dark brown sandy clay loam in the upper 9 inches and firm, moderately

alkaline, brown sandy clay loam in the lower 12 inches. Below that, to a depth of 47 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam. And to a depth of 68 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam.

The minor soils included in the map unit are the Clareville, Comitas, Lattas, Leming, Opelika, and Pharr soils. The deep, loamy, nearly level Clareville soils are on uplands. The deep, sandy, nearly level to gently sloping Comitas soils are on uplands and terraces. The deep, clayey, nearly level to gently sloping Lattas soils are on marine terraces. The deep, sandy, nearly level to gently sloping Leming soils are on uplands. The deep, loamy, nearly level Opelika soils are in slightly concave, weakly expressed drainageways and on low terraces on uplands adjacent to the drainageways. The deep, loamy, nearly level to gently sloping Pharr soils are on deltas or coastal terraces.

Most areas of this map unit are used as cropland and improved pasture.

The potential for cultivated crops is medium. Low rainfall and the hazard of water erosion are the main limitations. Grain sorghum, cotton, and flax are the main crops.

The potential for rangeland is medium. Native plants are mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and slow and moderate permeability, the potential for most urban uses is medium.

Deep, nearly level, clayey and loamy soils on bottom lands

The soils in this group make up about 1 percent of the county. The major soils are Aransas and Sinton soils. The surface layer of these soils is loamy or clayey, and the underlying layers also are loamy or clayey. These soils are well drained or poorly drained and are moderately permeable or very slowly permeable.

Most areas of these soils are used for improved pasture of coastal bermudagrass or as rangeland. Flooding limits the use of the soils for cultivated crops. The native plants are wildrye, bluestem, switchgrass, trichloris, vine-mesquite, buffalograss, and grama and hackberry, elm, willow, and pecan.

The soils in this group have low potential for urban and recreation uses.

9. Aransas-Sinton

Poorly drained and well drained, very slowly permeable and moderately permeable, clayey and loamy soils

This map unit consists of nearly level soils that have slopes of 0 to 1 percent. It makes up about 1 percent of the county. It is about 57 percent Aransas soils, 35 percent Sinton soils, and 8 percent minor soils.

Aransas soils have a surface layer that is about 40 inches thick. The layer is very firm, moderately alkaline, dark gray clay. Below that, to a depth of 65 inches, the soil is very firm, moderately alkaline, gray clay that has a few old cracks filled with dark gray material in the upper part.

Sinton soils have a surface layer that is about 34 inches thick. The layer is friable, moderately alkaline sandy clay loam that is very dark gray in the upper 10 inches and dark gray in the lower 24 inches. Below that, to a depth of 65 inches, the soil is friable, moderately alkaline, stratified sandy clay loam that is light brownish gray in the upper 16 inches and light gray in the lower 15 inches.

The minor soils in the map unit are the Odem soils. These are deep, loamy soils. They are nearly level to gently sloping soils on natural levees on bottom lands between the main stream channels and backwater areas that are adjacent to the uplands.

Most areas of this map unit are used as rangeland and improved pasture because flooding is a hazard to crops.

The potential for rangeland is high. Native plants are mid and tall grasses.

Because of shrinking and swelling with changes in moisture content, corrosivity to uncoated steel, low strength, and a flooding hazard, the potential for most urban uses is low.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying substratum, all the

soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Runge fine sandy loam, 1 to 3 percent slopes, is one of 5 phases within the Runge series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil associations.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Olmos association, undulating, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 5. Information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

1—Aransas clay. This is a deep, nearly level soil on flood plains. The surface is plane to slightly concave. Slope ranges from 0 to 1 percent. Areas are irregular to oblong in shape and are interconnected into a few large areas that are several hundred acres in size.

This soil has a surface layer that is about 42 inches thick. The layer is very firm, moderately alkaline, dark gray clay that has a few short slickensides in the lower part. Below that, to a depth of 65 inches, the soil is very firm, moderately alkaline, gray clay.

This soil is poorly drained. Runoff is very slow. Flood prevention measures and water storage structures help protect the soil from frequent flooding, but the soil is occasionally flooded following unusually heavy rainfall. When this soil is dry, cracks up to 1 inch wide form on the surface. Water enters the soil rapidly when the surface is cracked and very slowly when the surface is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but clay can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Sinton and Lattas soils. Also included are areas of Aransas soils that have a loamy or sandy overwash from adjacent upland soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. A few acres are in improved pasture of coastal bermudagrass.

The potential for grain sorghum and cotton is high. Cropping systems should be adapted for water management and maintenance of soil productivity and tilth. High residue producing crops are needed, and crop residue should be left on the soil surface. Grassed waterways, diversion terraces, and drainage ditches help to remove excess water.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for urban uses is low. Shrinking and swelling of the soil with changes in moisture content, low strength, corrosivity to uncoated steel, and flooding are the most limiting features. The potential for recreation uses is low. Flooding, wetness, and the clayey surface limit the use of this soil.

Capability subclass IIIw; Clayey Bottomland range site.

2—Aransas clay, frequently flooded. This is a deep, nearly level soil on flood plains. The surface is plane to slightly concave. The slope ranges from 0 to 1 percent. Areas of this soil are irregular to oblong in shape and range from 30 to 500 acres in size. They are flooded about twice each year for 2 to 7 days.

This soil has a surface layer that is about 40 inches thick. The layer is very firm, moderately alkaline, dark gray clay. Below that, to a depth of 65 inches, the soil is very firm, moderately alkaline, gray clay that has a few old cracks filled with dark gray material in the upper part.

This soil is poorly drained, and runoff is very slow. Flooding occurs mainly in the fall and spring. When this soil is dry, cracks up to 1 inch wide form on the surface. Water enters the soil rapidly when the surface is cracked and very slowly when it is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but clay can

impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Sinton and Lattas soils and areas of Aransas soils that have a sandy overwash from soils of the adjacent uplands. Some areas have been partly covered with clayey and loamy spoil material. These inclusions make up less than 15 percent of any one mapped area.

Most of this soil is used as rangeland. Some areas in the extensively cultivated part of the county are idle. A few areas are in improved pasture.

The potential of this soil for use as cropland is low because of the flood hazard. The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential of this soil for urban uses is low. Shrinking and swelling of the soil with changes in moisture content, low strength, corrosivity to uncoated steel, and the flooding hazard are the most limiting features. The potential for recreation uses is low. The flooding hazard, wetness, and the clayey surface are the limitations.

Capability subclass Vw; Clayey Bottomland range site.

3—Clareville loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly concave. Areas of this soil are irregular to oblong in shape and range from 10 to 350 acres in size.

The surface layer is about 11 inches thick. It is friable, neutral, dark gray loam in the upper 5 inches and friable, neutral, very dark gray clay loam in the lower 6 inches. Below that, to a depth of 25 inches, the soil is firm, mildly alkaline, very dark gray and dark grayish brown clay loam. To a depth of 38 inches, the soil is very firm, moderately alkaline, brown and grayish brown clay loam. Below that, to a depth of 46 inches, the soil is firm, moderately alkaline, grayish brown clay loam that is about 20 percent, by volume, soft masses and concretions of calcium carbonate. And to a depth of 64 inches, the soil is friable, moderately alkaline, very pale brown loam.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Opelika, Lattas, Racombes, and Czar soils. Also included are a few areas of a soil that is similar to this Clareville soil except that it has a dark surface layer less than 20 inches thick and may be calcareous within 10 inches of the surface. Also included are areas of Clareville soils that have slopes of more than 1 percent. Some pedons have a sandy clay loam surface layer. Also included in this map unit is an area of about 200 acres in downtown Alice that is 60 to 85 percent urban structures. Inclusions make up less than 15 percent of any one mapped area.

Most areas of this soil are farmed to cotton and grain sorghum. A few areas are used as rangeland.

The potential for cotton and grain sorghum is high. Cropping systems should be adapted to conserve moisture and maintain or improve soil productivity and tilth. Unless managed properly, the surface layer of this soil tends to become pulverized and crusty when cultivated. Crop residue returned to the surface helps prevent crusting. Contour farming helps to conserve moisture.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, low strength, and corrosivity to uncoated steel are the most limiting features. The potential for recreation uses is medium.

Capability subclass IIc; Clay Loam range site.

4—Comitas loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands. The surface is plane to slightly convex. Areas of this soil are oval to irregular in shape and range from 12 to 250 acres in size.

This soil has a surface layer that is about 32 inches thick. The layer is very friable, slightly acid, grayish brown loamy fine sand in the upper 7 inches and very friable, neutral, dark grayish brown loamy fine sand in the lower 25 inches. Below that, to a depth of 55 inches, the soil is very friable, mildly alkaline, brown fine sandy loam. To a depth of 62 inches, the soil is very friable, moderately alkaline, pale brown fine sandy loam. And to a depth of 75 inches, the soil is very friable, moderately alkaline, very pale brown fine sandy loam.

This soil is well drained. Runoff is very slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Leming, Sarita, Papalote, and Czar soils and areas of Comitas soils that have slopes of more than 3 percent. In many of these areas the soils have a surface layer that is less than 20 inches thick, and it may be moderately gullied. Also included are some areas of a soil that is similar to this Comitas soil except that the layer immediately below the surface layer is yellowish brown or light yellowish brown. Inclusions make up less than 15 percent of any one mapped area.

Most areas of this soil are used for improved pasture of coastal bermudagrass. A few level areas are cropland. Peanuts and watermelons are the main crops.

The potential for grain sorghum, peanuts, and watermelons is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce large quantities of residue should be used. Crop residue should be returned to the surface. Stripcropping is needed to control

wind erosion. Grassed waterways help to reduce erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Seepage, low strength, and the hazard of cutbanks caving are the main limitations. The potential for recreation uses is medium.

Capability subclass IIIs; Loamy Sand range site.

5—Czar fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Areas of this soil are irregular to oval in shape and range from 20 to 200 acres in size.

This soil has a surface layer that is about 14 inches thick. The layer is friable, dark gray fine sandy loam. It is neutral in the upper 5 inches and moderately alkaline in the lower 9 inches. Below that, to a depth of 32 inches, the soil is firm, moderately alkaline sandy clay loam. It is dark grayish brown in the upper 10 inches and brown in the lower 8 inches. To a depth of 40 inches, the soil is firm, moderately alkaline, light brownish gray sandy clay loam. And to a depth of 60 inches, the soil is firm, moderately alkaline, white sandy clay loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Racombes, Runge, Pharr, and Opelika soils and areas of Czar soils that have slopes of more than 1 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland, pastureland, and rangeland. Cotton and grain sorghum are the main crops.

The potential for cotton is high. The potential for grain sorghum is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Contour farming is helpful in conserving moisture.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban and recreation uses is high.

Capability subclass IIc; Sandy Loam range site.

6—Czar fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 10 to 150 acres in size.

This soil has a surface layer that is about 13 inches thick. The layer is friable, neutral, dark grayish brown fine sandy loam. Below that, to a depth of 34 inches, the soil is friable, moderately alkaline, dark brown sandy clay loam in the upper 9 inches and firm, moderately alkaline, brown sandy clay loam in the lower 12 inches. To a depth of 47 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam. And to a depth of 68 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Runge, Delfina, and Pharr soils and some areas of a soil that is similar to this Czar soil except that it has a dark surface layer less than 20 inches thick. Some areas have a sandy clay loam surface layer. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and rangeland. Cotton and grain sorghum are the main crops.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps control erosion, conserve moisture, and improve or maintain soil productivity. Crop residue should be returned to the surface. Terraces and contour farming help control water erosion and conserve moisture. Grassed waterways and diversion terraces help to reduce erosion.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban and recreation uses is high.

Capability subclass IIe; Sandy Loam range site.

7—Danjer clay, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is weakly concave to weakly convex. Areas of this soil are irregular to oblong in shape and range from 30 to 300 acres in size.

This soil has a surface layer of moderately alkaline, dark gray clay that is about 20 inches thick. The layer is friable in the upper 6 inches and very firm in the lower 14 inches. Below that, to a depth of 43 inches, the soil is very firm, moderately alkaline, grayish brown clay that has a few vertical seams of dark gray material in old closed cracks. To a depth of 65 inches, the soil is very firm, moderately alkaline, pink clay that is mottled in shades of red and yellow.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is high. The root zone is deep, but clay tends to impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Lattas and Pernitas soils and areas of Danjer soils that have a surface layer of sandy clay loam and clay loam. Also included are areas of Danjer soils that have slopes of more than 1 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland. Cotton, grain sorghum, and flax are the main crops. A few areas are in improved pasture of coastal bermudagrass.

The potential for cotton, grain sorghum, and flax is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue are needed, and the crop residue should be returned to the surface. Farming on the contour helps to conserve moisture.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Shrinking and swelling of the soil with changes in moisture content, low strength, the hazard of cutbanks caving, and very slow permeability are the main limitations. The potential for recreation uses is low because of the clayey surface texture and the very slow permeability.

Capability subclass IIs; Blackland range site.

8—Danjer clay, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is weakly concave to weakly convex. Areas of this soil are oblong in shape and range from 20 to 500 acres in size.

This soil has a surface layer of moderately alkaline, dark gray clay that is about 26 inches thick. The layer is firm in the upper 8 inches and very firm in the lower 18 inches. Below that, to a depth of 46 inches, the soil is very firm, moderately alkaline, grayish brown clay that has a few vertical seams of dark gray material in old closed cracks. To a depth of 72 inches, the soil is very firm, moderately alkaline, very pale brown clay that is mottled in shades of red and gray.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The root zone is deep, but the clay content tends to impede the movement of air, water, and roots. The hazard of water erosion is moderate.

Included in mapping are small areas of Lattas and Pernitas soils and areas of Danjer soils that have a sandy clay loam surface layer. Also included are areas of Danjer soils that have slopes of up to 5 percent. Inclusions make up less than 15 percent of any one mapped area.

Most areas of this soil are used as cropland and improved pasture of coastal bermudagrass. Grain sorghum, cotton, and flax are the main crops. A few areas are used as rangeland.

The potential for cotton, grain sorghum, and flax is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. High residue crops and soil improving crops should be used. Crop residue returned to the surface helps reduce runoff. Terracing and contour farming, grassed waterways, and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Shrinking and swelling of the soil with changes in moisture content, low strength, the hazard of cutbanks caving, and the very slow permeability are the main limitations. The potential for recreation uses is low because of the clayey surface layer and the very slow permeability.

Capability subclass IIIe; Blackland range site.

9—Delfina loamy fine sand, 0 to 2 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is plane to convex. Areas of this soil are oval in shape and range from 20 to several hundred acres in size.

This soil has a surface layer that is about 11 inches thick. The layer is very friable, slightly acid, brown loamy fine sand. Below that, to a depth of 30 inches, the soil is firm, brown sandy clay loam that has brown mottles. It is neutral in the upper 7 inches and moderately alkaline in the lower 12 inches. To a depth of 80 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam that is faintly mottled in shades of yellow in the upper 29 inches. It has black concretions and concretions of calcium carbonate in the lower 21 inches.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil tends to impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Comitas, Edroy, Leming, Opelika, Papagua, and Papalote soils. Also included are areas of a soil that is similar to this Delfina soil except that it has a surface layer less than 10 inches thick and secondary carbonates at a depth as shallow as 26 inches. Inclusions make up less than 15 percent of any one mapped area.

This soil is mostly used as cropland and improved pasture of coastal bermudagrass and buffelgrass. Grain sorghum, forage sorghums, and watermelons are the main crops.

The potential for grain sorghum, forage sorghums, and watermelons is medium. Cropping systems should be adapted to control erosion and maintain or improve soil productivity and tilth. High residue crops and cover crops are needed. Crop residue returned to the surface and stripcropping are needed to control wind erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, low strength, seepage, and moderately slow permeability are the most limiting features. The potential for recreation uses is medium.

Capability subclass IIIe; Loamy Sand range site.

10—Delfina fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 15 to several hundred acres in size.

This soil has a surface layer that is about 12 inches thick. The layer is very friable, slightly acid, brown fine sandy loam. Below that, to a depth of 16 inches, the soil is firm, neutral, brown sandy clay loam. To a depth of 28 inches, it is very firm, mildly alkaline, brown sandy clay loam that is mottled in shades of red, yellow, and gray. Below that, to a depth of 36 inches, the soil is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 80 inches, the soil is firm, moderately alkaline, reddish yellow sandy clay loam that is about 4 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil tends to impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Opelika, Papagua, Papalote, and Runge soils. Also included are areas of a soil that is similar to Delfina soils except that it has secondary carbonates at a depth as shallow as 26 inches. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and improved pasture of coastal bermudagrass and buffelgrass. Grain sorghum, forage sorghums, and watermelons are the main crops.

The potential for grain sorghum, forage sorghums, and watermelons is high. Cropping systems should be adapted to control erosion and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Contour farming helps conserve moisture.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, low strength, and moderately slow permeability are the limitations. The potential for recreation uses is high.

Capability subclass IIIe; Tight Sandy Loam range site.

11—Delfina fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is convex. Areas of this soil are irregular to oval in shape and range from 10 to 200 acres in size.

This soil has a surface layer that is about 12 inches thick. The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 15 inches, the soil is friable, neutral, brown sandy clay loam that has gray mottles. To a depth of 28 inches, the soil is firm, mildly alkaline, brown sandy clay loam that is mottled in shades of gray and brown. The layer below that, to a depth of 50 inches, is firm, moderately alkaline, pink sandy clay loam that is mottled in shades of gray and brown; in the lower 14 inches, it is about 5 percent, by volume, soft masses of calcium carbonate. And to a depth of 72 inches, the soil is firm, moderately alkaline, reddish yellow sandy clay loam.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is moderate.

Included in mapping are small areas of Opelika, Papalote, and Runge soils. Also included are areas of a soil that is similar to Delfina soils except that it has secondary carbonates at a depth as shallow as 26 inches. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and improved pasture of buffelgrass. Watermelons, cotton, grain sorghum, and forage sorghums are the main crops.

The potential for watermelons, cotton, grain sorghum, and forage sorghums is medium. Cropping systems should be adapted to control erosion, conserve moisture, and maintain or improve soil productivity and tilth. Crops that are close spaced and produce much residue are needed. Residue should be left on the surface. Contour farming and terracing help conserve moisture and control water erosion. Grassed waterways and diversion terraces also help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, low strength, and moderately slow permeability are the limitations. The potential for recreation uses is high.

Capability subclass IIIe; Tight Sandy Loam range site.

12—Delmita fine sandy loam, 1 to 3 percent slopes. This is a moderately deep, gently sloping soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 10 to 100 acres in size.

This soil has a surface layer that is about 10 inches thick. The layer is very friable, neutral, brown fine sandy

loam. Below that, to a depth of 30 inches, the soil is friable, neutral, reddish brown sandy clay loam. The underlying material consists of white caliche that is strongly cemented in the upper part.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep. The hazard of erosion is moderate.

Included in mapping are small areas of Goliad, Lacoste, Papalote, and Runge soils and areas of Delmita soils that have slope of less than 1 percent. Also included are a few areas of a soil that is similar to Delmita soils except that it is more than 40 inches deep. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and rangeland. Cotton and grain sorghum are the main crops.

The potential for cotton and grain sorghum is low because of the low available water capacity. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Terraces and contour farming help prevent erosion and conserve moisture. Grassed waterways help to reduce erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Corrosivity to steel and depth to a cemented pan are the limitations. The potential for recreation uses is high.

Capability subclass IVe; Sandy Loam range site.

13—Edroy clay. This is a deep, nearly level soil on uplands. The surface is plane to slightly concave. Slopes range from 0 to 1 percent. Areas of this soil are oval to irregular in shape and range from 10 to 250 acres in size.

This soil has a surface layer that is about 18 inches thick. The layer is friable, slightly acid, dark gray clay in the upper 8 inches and friable, neutral, dark gray clay with a few slickensides in the lower 10 inches. Below that, to a depth of 28 inches, the soil is very firm, moderately alkaline, gray clay loam that has a few dark gray vertical streaks. To a depth of 42 inches, it is firm, moderately alkaline, light gray clay loam. Below that, to a depth of 53 inches, the soil is firm, moderately alkaline, light gray sandy clay loam that has a few black concretions and a few concretions of calcium carbonate. And to a depth of 72 inches, the soil is very friable, moderately alkaline, white loamy fine sand.

This soil is poorly drained. Runoff is very slow. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the clay content can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Lattas and Opelika soils. Also included are some areas of a soil that is similar to Edroy soils except that it is not so deep. These inclusions make up less than 10 percent of any one mapped area.

This soil is used mostly as cropland. Cotton and grain sorghum are the main crops.

The potential for cotton and grain sorghum is medium. Soil wetness is the main problem. In most years, simple drainage practices can increase yields and expedite tillage operations. In years of above-normal rainfall, planting and tillage may be delayed. A cropping system should be adapted for water management and to maintain soil productivity and tilth. Crop residue returned to the surface reduces surface crusting and improves seed germination. Diversion terraces, field and lateral drainage ditches, and grassed waterways are needed for water management.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, very slow permeability, wetness, and flooding are the limitations. The potential for recreation uses is low. Wetness, flooding, and the clayey surface texture are the limitations.

Capability subclass IIIw; Claypan Prairie range site.

14—Edroy clay, depressional. This is a deep, nearly level soil on uplands. The surface is concave and depressional. Slopes range from 0 to 1 percent. Areas of this soil are oval to oblong in shape and range from 3 to 80 acres in size.

This soil has a surface layer that is about 22 inches thick. The layer is very firm, slightly acid, dark gray clay. Below this, to a depth of 42 inches, the soil is very firm, gray clay loam. It is neutral in the upper 8 inches and moderately alkaline in the lower 12 inches. To a depth of 50 inches, it is firm, moderately alkaline, light gray and light brownish gray sandy clay loam that has a few concretions and soft masses of calcium carbonate. And to a depth of 72 inches, the soil is friable, moderately alkaline, pinkish gray sandy clay loam.

This soil is poorly drained, and runoff is ponded. The soil is saturated with water or has water covering the surface for several days in most years; it is usually dry in the summer. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the clay content can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Lattas, Opelika, and Papagua soils. Also included are some areas of a soil that is similar to Edroy soils except that it has a darker surface layer. These inclusions make up less than 10 percent of any one mapped area.

This soil is used mostly as rangeland. It cannot be used economically as cropland.

The potential for crops is low. Areas of this soil are generally small and difficult to drain.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is low.

The potential for most urban uses is low. Shrinking and swelling of this soil with changes in moisture content, corrosivity to steel, very slow permeability, wetness, flooding, and low strength are the limitations. The potential for recreation uses is low because of wetness, flooding, and the clayey surface texture.

Capability subclass Vw; Lakebed range site.

15—Goliad fine sandy loam, 0 to 1 percent slopes. This is a moderately deep, nearly level soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 10 to 70 acres in size.

This soil has a surface layer that is about 12 inches thick. The layer is friable, mildly alkaline, dark brown fine sandy loam. Below that, to a depth of 18 inches, the soil is friable, moderately alkaline, reddish brown sandy clay loam. To a depth of 38 inches, it is firm, moderately alkaline, yellowish red sandy clay. The underlying material consists of white, fractured, indurated caliche that has interstices filled with loamy material.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is slight.

Included in mapping are small areas of Delmita, Lacoste, Parrita, and Runge soils. Also included are small areas of a soil similar to this Goliad soil except that the surface layer is lighter in color. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Contour farming helps conserve moisture. Grassed waterways and diversion terraces help to control runoff.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of this soil with changes in moisture content, corrosivity to steel, moderately slow permeability, low strength, and a cemented pan are the limitations. The potential for recreation uses is high.

Capability subclass IIs; Sandy Loam range site.

16—Goliad fine sandy loam, 1 to 3 percent slopes. This is a moderately deep, gently sloping soil on uplands. The surface is slightly convex. Areas of this soil are irregular in shape and range from 20 to 300 acres in size.

This soil has a surface layer that is about 9 inches thick. The layer is friable, neutral, dark grayish brown fine sandy loam. Below that, to a depth of 14 inches, the soil is friable, mildly alkaline, dark brown sandy clay loam. To a depth of 29 inches, it is firm, moderately alkaline sandy clay. It is brown in the upper 12 inches and strong brown in the lower 3 inches. The underlying material consists of white indurated caliche.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Delmita, Lacoste, Parrita, and Runge soils and areas of Goliad soils that have slope of more than 3 percent. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. A few areas of this soil are used as improved pasture of buffelgrass.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Terraces and contour farming are needed to control erosion and conserve moisture. Grassed waterways and diversion terraces help to reduce erosion.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, moderately slow permeability, low strength, and a cemented pan are the limitations. The potential for recreation uses is high.

Capability subclass IIIe; Sandy Loam range site.

17—Goliad sandy clay loam, 0 to 1 percent slopes. This is a moderately deep, nearly level soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 30 to 500 acres in size.

This soil has a surface layer that is about 11 inches thick. The layer is friable, mildly alkaline, very dark grayish brown sandy clay loam. Below that, to a depth of 15 inches, the soil is friable, moderately alkaline, brown sandy clay. To a depth of 28 inches, it is firm, moderately alkaline, reddish brown clay. The underlying material consists of white and pinkish white indurated caliche.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is slight.

Included in mapping are small areas of Lacoste, Parrita, and Runge soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. A few areas are cultivated to grain sorghum.

The potential for cotton and grain sorghum is medium. Cropping systems should be adapted to conserve moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Contour farming helps conserve moisture.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, moderately slow permeability, low strength, and a cemented pan are the limitations. The potential for recreation uses is medium.

Capability subclass IIs; Clay Loam range site.

18—Goliad sandy clay loam, 1 to 3 percent slopes. This is a moderately deep, gently sloping soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 20 to 250 acres in size.

This soil has a surface layer that is about 9 inches thick. The layer is friable, moderately alkaline, dark brown sandy clay loam. Below that, to a depth of 13 inches, the soil is friable, moderately alkaline, dark reddish brown clay loam. To a depth of 26 inches, it is firm, moderately alkaline, yellowish red clay. The underlying material consists of indurated caliche.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Lacoste, Parrita, and Runge soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas, it is used for grain sorghum.

The potential for cotton and grain sorghum is medium. Cropping systems should be adapted to control erosion and maintain or improve soil productivity and tilth. Residue should be returned to the surface. Terraces and contour farming help to conserve moisture and control erosion. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil, corrosivity to steel, moderately slow permeability, low strength, and a cemented pan are limitations. The potential for recreation uses is medium.

Capability subclass IIIe; Clay Loam range site.

19—Lacoste-Olmos association, gently undulating. This association is on uplands. The surface is convex. Slopes range from 1 to 5 percent. Areas are irregular to oval in shape and range from 20 to 600 acres in size.

Lacoste soils make up about 59 percent of the association, Olmos soils about 27 percent, and minor soils about 14 percent. In some areas, the Lacoste and Olmos soils could have been mapped separately at the scale used; but these soils are similar in use and management so separation was not necessary.

Lacoste soils are on ridgetops. The surface layer is about 7 inches thick. It is very friable, mildly alkaline, brown fine sandy loam in the upper 2 inches and friable, moderately alkaline, brown fine sandy loam in the lower 5 inches. Below that, to a depth of 12 inches, the soil is friable, moderately alkaline, reddish brown sandy clay loam. The underlying material is white, strongly cemented caliche that is fractured in the upper part.

Olmos soils are on the upper part of side slopes. The surface layer is about 9 inches thick. In the upper 3 inches, it is friable, moderately alkaline, grayish brown gravelly loam that is about 3 to 5 percent concretions and fragments of calcium carbonate that are mostly less than 5 millimeters wide and about 20 percent caliche fragments. In the lower 6 inches, it is friable, moderately alkaline, grayish brown gravelly loam that is about 5 to 10 percent concretions and fragments of calcium carbonate that are mostly less than 1 centimeter wide and about 30 percent caliche fragments. In the upper 4 inches, the underlying material is white and pink, strongly cemented, laminar caliche that has solution channels that are filled with gray and dark gray soil material; below that, it is white, weakly cemented, nodular caliche that has interstices that are filled with light brownish gray loamy soil material.

These soils are well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate.

Included in mapping and making up less than 15 percent of any one mapped area are small areas of Goliad, Parrita, Pernitas, and Pettus soils and a few eroded areas where caliche is at or near the surface.

This association is used mostly as rangeland because of slope, shallow rooting depth, susceptibility to water erosion, and very low available water capacity.

The Olmos soils are not suitable for cultivation. The potential of the Lacoste soils for grain sorghum is low. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops producing much residue are needed. Residue should be returned to the soil. Terraces and contour farming help to control erosion and conserve moisture. If cuts for excavation are more than 12 inches deep, there is a hazard of cutting into a layer of weakly cemented caliche.

The potential for native range plants is low for the Olmos soils and medium for the Lacoste soils. In favorable years, this association produces low to moderate

yields of short and mid grasses. The potential for wildlife habitat is low.

The potential for most urban uses is low. Seepage, corrosivity to steel, and a cemented pan are the limitations. The potential for recreation uses is low for the Olmos soils and high for the Lacoste soils.

Capability subclass IVe, Shallow Sandy Loam range site, Lacoste part; capability subclass VIIs, Shallow Ridge range site, Olmos part.

20—Lattas clay, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane. Areas of this soil are irregular to oval in shape and range from 20 to several thousand acres in size.

The surface layer is moderately alkaline, dark gray, and very dark gray clay about 29 inches thick. It is firm in the upper 5 inches and very firm in the next 16 inches. In the lower 8 inches it is very firm and has a few slickensides. Below that, to a depth of 53 inches, the soil is very firm, moderately alkaline, gray clay that has a few slickensides and a few old cracks filled with dark gray soil material. The underlying material, to a depth of 70 inches, is very firm, moderately alkaline, light brownish gray clay that has a few old cracks filled with dark gray soil material.

This soil is somewhat poorly drained. Runoff is very slow. After deep plowing, the surface layer generally has a microrelief of alternating dark colored microdepressions and lighter colored microknolls (fig. 4).

When this soil is dry, cracks up to 1 1/2 inches wide form on the surface. Water enters the soil rapidly when the surface layer is cracked and very slowly when it is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is high. The root zone is deep, but clay can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Clareville, Danjer, Edroy, Opelika, and Pharr soils. Also included are areas of a soil similar to this Lattas soil except that the upper part of the surface layer is sandy clay loam or clay loam. Also included are areas of Lattas soils that have slopes of more than 1 percent. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland. Cotton, grain sorghum, and flax are the main crops (fig. 5). A few areas are used as rangeland and improved pasture of coastal bermudagrass.

Figure 4.—Deep plowing on Lattas clay, 0 to 1 percent slopes, has left dark colored microdepressions and lighter colored microknolls.

Figure 5.—Lattas clay, 0 to 1 percent slopes, has a high potential for flax.

The potential for cotton, grain sorghum, and flax is high. Because of poor drainage, crop yields are reduced in years of above-normal rainfall. Also, if cultivated when the moisture content is too high, the soil surface can become cloddy. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce a large amount of residue should be used. Residue returned to the surface helps conserve moisture, prevent crusting, and improve tilth. Drainage ditches can help remove excess water in years of abnormally high rainfall. Land smoothing generally is necessary.

The potential for native range plants is medium. In favorable years this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Shrinking and swelling of the soil, corrosivity to steel, low strength, and very slow permeability are the limitations. The potential for recreation uses is low. The clayey surface layer limits the use of this soil.

Capability subclass IIIs; Blackland range site.

21—Lattas clay, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas of this soil are irregular to oval in shape and range from 30 to 250 acres in size.

This soil has a surface layer that is about 16 inches thick. The layer is friable, moderately alkaline, dark gray clay in the upper 6 inches and firm, moderately alkaline,

very dark gray clay that has a few slickensides in the lower 10 inches. The layer below that, to a depth of 42 inches, is firm, moderately alkaline clay; it is dark gray and gray in the upper 12 inches and light brownish gray in the lower 14 inches. To a depth of 65 inches, the soil is firm, moderately alkaline, light gray clay.

This soil is somewhat poorly drained. Runoff is slow. When this soil is dry, cracks up to 1 1/2 inches wide form on the surface. Water enters the soil rapidly when the surface is dry and cracked and very slowly when it is wet and the cracks are sealed. Permeability is very slow, and the available water capacity is high. The root zone is deep, but clay can impede the movement of air, water, and roots. The hazard of water erosion is moderate.

Included in mapping are small areas of Clareville, Danjer, and Pharr soils. Also included are areas of a soil similar to this Lattas soil except that the upper part of the surface layer is sandy clay loam or clay loam. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland. Cotton, grain sorghum, and flax are the main crops. A few areas are used as rangeland and improved pasture of coastal bermudagrass.

The potential for cotton and grain sorghum is high. The potential for flax is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce a large amount of residue should be used. Residue returned to the surface helps conserve moisture, prevent crusting, and improve tilth. Terraces, contour farming, and grassed waterways help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, low strength, and very slow permeability are the limitations. The potential for recreation uses is low because of the clayey surface layer.

Capability subclass IIIe; Blackland range site.

22—Leming loamy fine sand, 0 to 5 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is plane to convex. Areas of the soil are irregular in shape and range from 20 to 90 acres in size.

This soil has a surface layer that is about 24 inches thick. The layer is very friable, neutral, brown loamy fine sand in the upper 13 inches and very friable, slightly acid, pale brown loamy fine sand in the lower 11 inches. Below that, to a depth of 55 inches, the soil is firm, neutral, light brownish gray sandy clay that is mottled in shades of red and yellow in the upper 11 inches; firm, neutral, light brownish gray and very pale brown sandy clay loam that has brownish mottles in the next 12 inches; and firm, mildly alkaline, light gray sandy clay loam that has brownish mottles in the lower 8 inches. To a depth of 65 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam that is about 5 to 10 percent soft masses and concretions of calcium carbonate.

This soil is moderately well drained to somewhat poorly drained. Runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Comitas, Delfina, and Papalote soils. Also included are areas of a soil similar to this Leming soil except that the surface layer is thicker than 40 inches. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. A few areas are used as improved pasture of coastal bermudagrass.

The potential for cotton and grain sorghum is high. Cropping systems should be adapted to control erosion and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Crop residue should be returned to the surface. Stripcropping is needed to control wind erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, slow permeability, and low strength are the limitations. The potential for recreation uses is medium because of the sandy surface layer.

Capability subclass IIIe; Sandy range site.

23—Miguel fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is plane to slightly convex. Areas of this soil are oblong to oval in shape and range from 10 to 200 acres in size.

This soil has a surface layer that is about 10 inches thick. The layer is friable, slightly acid, grayish brown fine sandy loam. Below that, to a depth of 13 inches, the soil is firm, neutral, brown sandy clay that has brownish mottles. To a depth of 29 inches, it is very firm, neutral, brown sandy clay that is mottled in shades of red. Below that, to a depth of 33 inches, the soil is very firm, moderately alkaline, reddish yellow sandy clay. To a depth of 45 inches, it is friable, moderately alkaline, reddish yellow sandy clay loam that is about 3 percent, by volume, concretions of calcium carbonate. And to a depth of 60 inches, the soil is friable, moderately alkaline, pink sandy clay loam.

This soil is well drained. Runoff is medium. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is moderate.

Included in mapping are small areas of Opelika, Papalote, and Runge soils and small areas of a Miguel soil that has a loamy fine sand surface layer. Also included are areas of a soil that is similar to this Miguel soil except that it has secondary carbonates at a depth of less than 28 inches. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland and improved pasture of coastal bermudagrass.

The potential for cotton and grain sorghum is low. Cropping systems should be adapted to control erosion and maintain or improve soil productivity and tilth. Crop residue returned to the surface helps prevent erosion and improve tilth. Terraces and contour farming help to reduce erosion. Grassed waterways and diversion terraces help remove excess water during heavy rains.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, and very slow permeability are the limitations. The potential for recreation uses is medium because of very slow permeability.

Capability subclass IIIe; Tight Sandy Loam range site.

24—Odem fine sandy loam. This is a deep, nearly level soil on flood plains. The surface is plane to slightly convex. Slopes range from 0 to 1 percent. Areas of this soil are irregular to oblong in shape and range from 20 to 80 acres in size.

This soil has a surface layer that is about 46 inches thick (fig. 6). The layer is friable, moderately alkaline fine sandy loam that is grayish brown in the upper 6 inches and dark grayish brown in the lower 40 inches. Below that, to a depth of 72 inches, the soil is friable, moderately alkaline, light brownish gray fine sandy loam.

This soil is moderately well drained to well drained. Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight.

Included in mapping are small areas of Opelika, Papagua, and Sinton soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland, rangeland, and improved pasture of buffelgrass or coastal bermudagrass.

The potential is medium for cotton and high for grain sorghum. Cropping systems should be adapted for water management and to control moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the soil surface.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Flooding and seepage are the limitations. The potential for recreation uses is medium because of flooding.

Capability subclass IIc; Loamy Bottomland range site.

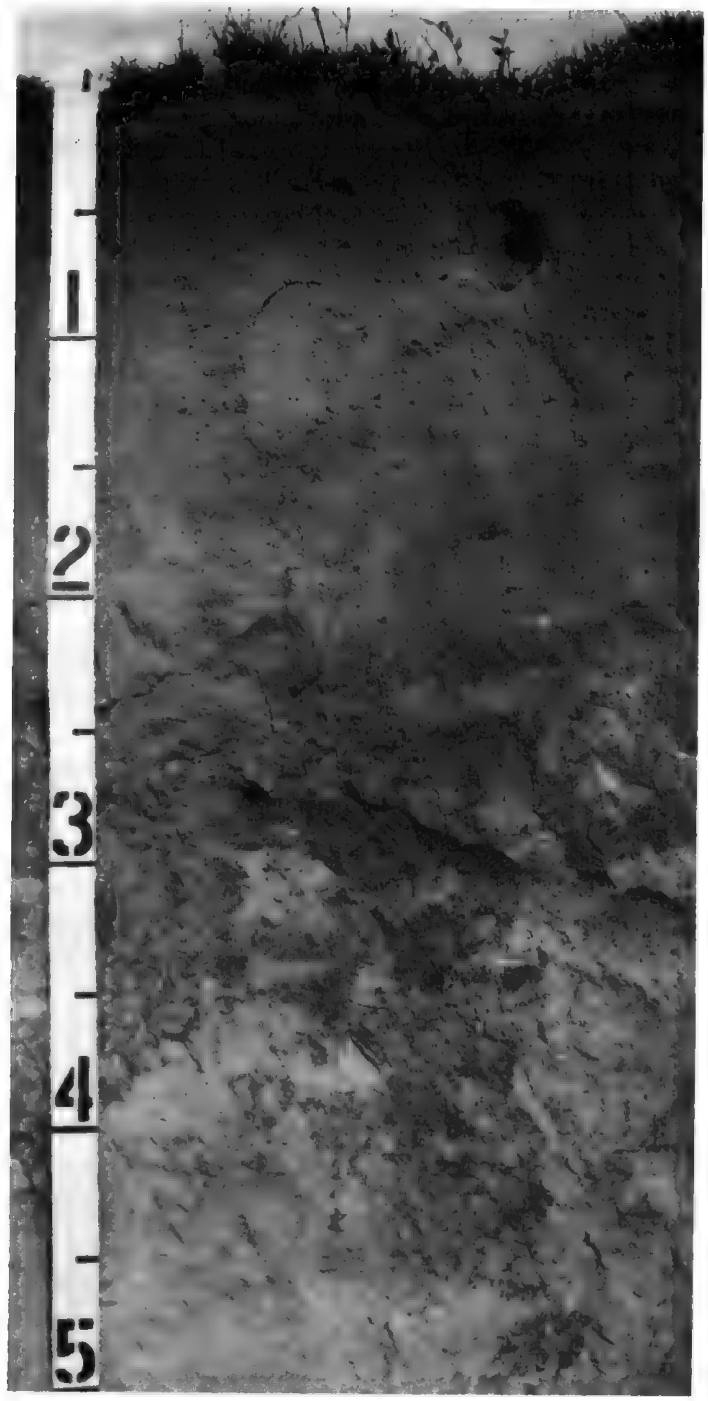

Figure 6.—Profile of Odem fine sandy loam.

25—Oil-Waste land. Oil-Waste land consists of small areas of different kinds of soils that have been affected by oil-field activity. Vegetation is sparse and of poor quality. These areas range from 3 to 15 acres in size.

The soils have been damaged by heavy machinery and by the addition of oil derivatives and by-products such as brine, drilling mud, and sludge.

This map unit does not include small reservoirs that are used to contain oil or oil waste products. These reservoirs are generally less than 2 acres in size and are easily identified by photo interpretation.

The productivity of these soils is drastically reduced or destroyed depending on the kind and amount of damage received and the length of time the soil is exposed to the damaging agent.

The potential is low for any use that requires vegetation.

Capability subclass not assigned.

26—Olmos association, undulating. The soils in this association are on uplands. The surface is convex. Slopes range from 1 to 8 percent. Areas are irregular, oval, or oblong in shape and range from 20 to several hundred acres in size.

This association is made up of about 72 percent Olmos soils and similar soils and 28 percent other soils. The areas of this map unit are much larger than those of other map units in the county, and the composition is more variable. Mapping has been controlled for the anticipated use of the areas.

Olmos soils are on ridgetops and upper side slopes. They have a surface layer that is about 9 inches thick. The layer, in the upper 3 inches, is friable, moderately alkaline, grayish brown gravelly loam that is about 3 to 5 percent concretions and fragments of calcium carbonate mostly less than 5 millimeters wide and about 20 percent caliche fragments. In the lower 6 inches it is friable, moderately alkaline, grayish brown gravelly loam that is about 5 to 10 percent concretions and fragments of calcium carbonate mostly less than 1 centimeter wide and about 30 percent caliche fragments. The underlying material, in the upper 4 inches, is white and pink, strongly cemented, laminar caliche that has solution channels filled with gray and dark gray material. Below that, it is white, weakly cemented, nodular caliche that has interstices filled with light brownish gray loamy material (fig. 7).

The soils in this association are well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate to severe.

Included in mapping are small areas of Goliad, Lacoste, Parrita, Pernitas, and Pettus soils and a few eroded areas where the caliche is at or near the surface. Also included is a soil that is similar to Olmos soils except that it has a lighter colored surface layer. Included soils make up about 28 percent of any mapped area.

This association is used mostly as rangeland because of slope, shallow rooting depth, susceptibility to water erosion, and very low available water capacity. This association is not suited to use as cropland.

The potential for native range plants is low. In favorable years, this association produces low yields of short and mid grasses. The potential for wildlife habitat is low.

The potential for most urban uses is low. Seepage, corrosivity to steel, and a cemented pan are the limitations. Because of stoniness, the potential for recreation uses is low.

Capability subclass VIIs; Shallow Ridge range site.

27—Opelika fine sandy loam. This is a deep, nearly level soil on uplands. The surface is plane to slightly concave. Slopes range from 0 to 1 percent. Areas are irregular to oblong in shape and range from 4 to 400 acres in size.

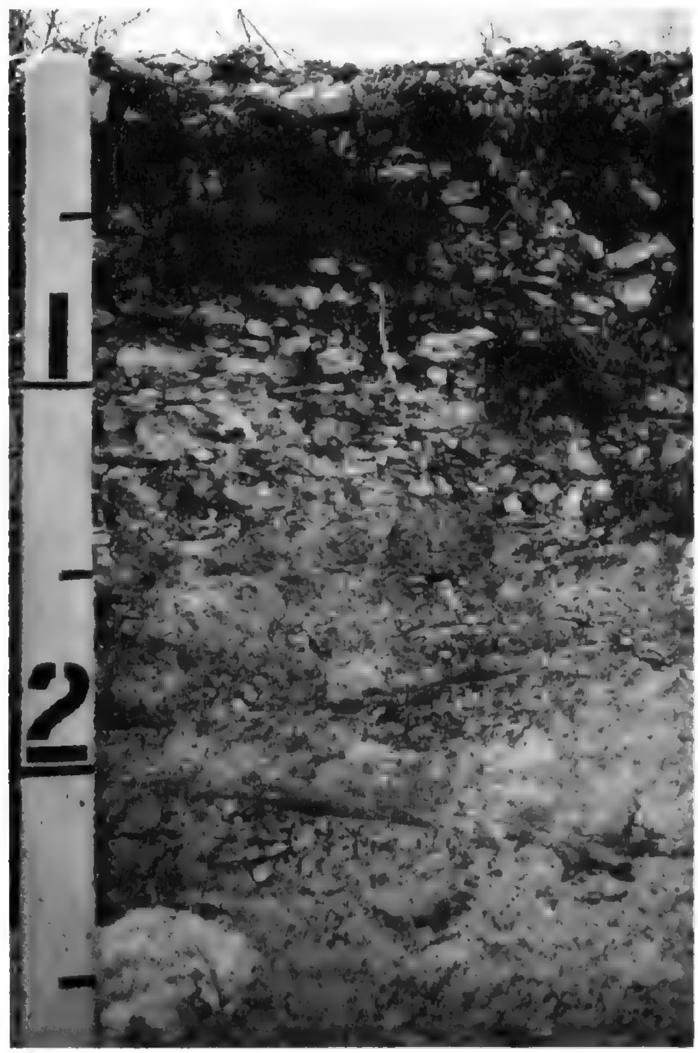

Figure 7.—Olmos gravelly loam has caliche at a depth of about 9 inches.

This soil has a surface layer that is about 4 inches thick. The layer is friable, neutral, gray fine sandy loam. Below that, to a depth of 10 inches, the soil is firm, mildly alkaline, dark gray sandy clay. To a depth of 19 inches, it is firm, moderately alkaline, dark gray sandy clay loam. Below that, to a depth of 30 inches, it is friable, moderately alkaline, gray sandy clay loam that has streaks of light brownish gray material. To a depth of 60 inches, the soil is friable, moderately alkaline, light gray sandy clay loam that has yellowish mottles.

This soil is somewhat poorly drained. Runoff is slow. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Clareville, Delfina, Edroy, Papagua, Papalote, Pharr, and Racombes soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland, rangeland, and improved pasture of buffelgrass and coastal bermudagrass. Cotton and grain sorghum are the main crops.

The potential for cotton, grain sorghum, and flax is low. This soil is hard and crusty when dry, and it forms clods if it is plowed when too wet or dry. It is droughty because of the poor intake of water in the subsoil. A cropping system should be used that helps to conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Residue returned to the surface improves soil tilth, increases water intake, and helps prevent crusting. Grassed waterways help to remove excess water.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Corrosivity to steel, very slow permeability, flooding, wetness, and low strength are the limitations. The potential for recreation uses is medium because of wetness.

Capability subclass IIIw; Claypan Prairie range site.

28—Opelika fine sandy loam, depressional. This is a deep, nearly level soil on uplands. The surface is slightly concave. Slopes range from 0 to 1 percent. Areas are irregular to oblong in shape and range from 10 to several hundred acres in size.

This soil has a surface layer that is about 8 inches thick. The layer is friable, neutral, gray fine sandy loam. Below that, to a depth of 22 inches, the soil is very firm, moderately alkaline, dark gray sandy clay loam. To a depth of 33 inches, it is firm, moderately alkaline, gray sandy clay loam that has brownish mottles. And to a depth of 60 inches, the soil is firm, moderately alkaline, white sandy clay loam that is mottled in shades of brown and gray.

This soil is somewhat poorly drained. Runoff is slow. This soil receives water from soils in higher positions and overflow from narrow stream channels during heavy rainfall. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in some areas of this soil are small areas of Clareville, Edroy, Papagua, Papalote, and Racombes soils. Also included are areas of a soil that is similar to Opelika soils except that the subsoil is more clayey. The included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland, rangeland, and improved pasture of buffelgrass and coastal bermudagrass. Cotton and grain sorghum are the main crops.

The potential for cotton, grain sorghum, and flax is low. This soil is hard and crusty when dry; clods form if the soil is plowed when too wet or dry. A cropping system should be used that helps to conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Residue returned to the surface helps improve soil tilth, increase water intake, and reduce surface crusting. Diversion terraces and grassed waterways are needed to help remove excess water.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is low. Corrosivity to steel, very slow permeability, flooding, wetness, and low strength are the limitations. The potential for recreation uses is medium because of wetness.

Capability subclass IIIw; Claypan Prairie range site.

29—Papagua soils, depressional. This map unit consists of deep, nearly level soils on uplands. The surface is slightly concave. Slopes range from 0 to 1 percent. Areas are oblong in shape and range from 20 to 200 acres in size.

This map unit is made up of about 84 percent Papagua soils and 16 percent other soils. The soils are not uniform and do not occur in a regular pattern.

These soils have a surface layer that is about 16 inches thick. The layer is very friable, neutral, light brownish gray loamy fine sand. Below that, to a depth of 30 inches, the soil is firm, neutral, light brownish gray sandy clay that is mottled in shades of yellow and brown. To a depth of 46 inches, it is firm, neutral, light brownish gray sandy clay loam that has brown and gray mottles. Below that, to a depth of 57 inches, it is firm, moderately alkaline, light brownish gray sandy clay loam. To a depth of 65 inches, the soil is firm, moderately alkaline, very pale brown sandy clay loam.

These soils are moderately well drained. Runoff is very slow to ponded. These soils receive water from adjacent soils, and they are occasionally briefly flooded during heavy rainfall. Permeability is slow, and the available

water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Delfina, Edroy, Leming, Opelika, and Papalote soils. A few areas of Papagua soils are covered by a layer of outwash that is less than 6 inches thick. The included soils make up as much as 40 percent of some mapped areas, but generally they make up less than 20 percent.

The soils in this map unit are used mostly as rangeland and improved pasture of buffelgrass and coastal bermudagrass. In a few areas, they are cultivated to grain sorghum.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps to conserve moisture and maintain or improve soil productivity and tilth. Crop residue returned to the surface helps prevent erosion and conserve moisture. Grassed waterways, diversion terraces, field ditch drains, and lateral drains are needed to control excess water during heavy rainfall.

The potential for native range plants is high. In favorable years, these soils produce good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soils with changes in moisture content, corrosivity to steel, slow permeability, flooding, and wetness are the limitations. The potential for recreation uses is medium because of wetness.

Capability subclass IIIw; Ramadero range site.

30—Papalote loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is plane to slightly convex. Areas are irregular to oval in shape and range from 5 to several hundred acres in size.

This soil has a surface layer that is about 17 inches thick. The layer is very friable, slightly acid loamy fine sand that is pale brown in the upper 8 inches and brown in the lower 9 inches. The layer below that extends to a depth of 41 inches. In the upper 8 inches, it is very firm, mildly alkaline, brown sandy clay that is mottled in shades of red, yellow, and gray; in the next 9 inches it is very firm, moderately alkaline, pinkish gray sandy clay that has reddish and brownish mottles; and in the lower 7 inches it is firm, moderately alkaline, light brown sandy clay that has yellowish mottles. Below that, to a depth of 65 inches, the soil is firm, moderately alkaline, pink sandy clay that is 3 to 5 percent soft masses and concretions of calcium carbonate.

This soil is moderately well drained. Runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Comitas, Delfina, Leming, Opelika, and Runge soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used as rangeland, cropland, and improved pasture of buffelgrass and coastal bermudagrass. Peanuts, watermelons, and grain sorghum are the main crops.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps control erosion and improve or maintain soil productivity and tilth. Crop residue should be returned to the surface. Stripcropping can help control wind erosion. Grassed waterways help to remove excess water.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soils with changes in moisture content, corrosivity to steel, slow permeability, and low strength are the limitations. The potential for recreation uses is medium because of the sandy surface layer.

Capability subclass IIe; Loamy Sand range site.

31—Papalote fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Areas are irregular to oblong in shape and range from 5 to 100 acres in size.

This soil has a surface layer that is about 16 inches thick. The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 20 inches, the soil is very firm, mildly alkaline, brown sandy clay that is mottled in shades of red and gray. To a depth of 31 inches, it is very firm, moderately alkaline, brown sandy clay that has mottles in shades of red and brown. Below that, to a depth of 38 inches, the soil is very firm, moderately alkaline, light brown sandy clay. To a depth of 49 inches, it is firm, moderately alkaline, light brown sandy clay loam. And to a depth of 65 inches, the soil is firm, moderately alkaline, pink sandy clay loam that is about 2 to 4 percent, by volume, soft masses of calcium carbonate.

This soil is moderately well drained. Runoff is slow. Permeability is slow, and the available water capacity is medium. The root zone is deep, but the blocky structure of the subsoil can impede the movement of air, water, and roots. The hazard of water erosion is slight.

Included in mapping are small areas of Delfina, Opelika, and Runge soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and improved pasture of buffelgrass and coastal bermudagrass. Grain sorghum is the main crop.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue and improve the

soil should be used. Crop residue should be returned to the soil surface. Contour farming helps conserve moisture. Grassed waterways and diversion terraces help to remove excess water.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, slow permeability, and low strength are the limitations. The potential for recreation uses is high.

Capability subclass IIs; Tight Sandy Loam range site.

32—Parrita sandy clay loam, 0 to 3 percent slopes. This is a shallow, nearly level to gently sloping soil on uplands. The surface is plane to slightly convex. Areas are irregular to oval in shape and range from 10 to 300 acres in size.

This soil has a surface layer that is about 5 inches thick. The layer is friable, mildly alkaline, dark brown sandy clay loam. The layer below that extends to a depth of 17 inches. It is firm, moderately alkaline, dark reddish brown sandy clay loam in the upper 4 inches and very firm, moderately alkaline, reddish brown clay in the lower 8 inches. The underlying material consists of white and pinkish white, strongly cemented and laminar caliche that has a few fine fractures.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate.

Included in mapping are small areas of Goliad, Lacoste, and Olmos soils. Also included are areas of a soil that is similar to Parrita soils except the surface layer is lighter in color and the subsoil is less clayey. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland.

The potential for grain sorghum is low. A cropping system should be used that helps control erosion and maintain soil productivity. Crop residues should be returned to the surface. Contour farming and terraces can help control erosion and conserve moisture.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soils with changes in moisture content, corrosivity to steel, a cemented pan, and low strength are the limitations. The potential for recreation uses is medium because the surface layer is too clayey.

Capability subclass IIIe; Shallow Sandy Loam range site.

33—Pernitas fine sandy loam, 1 to 5 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is convex. Areas are irregular to oval in shape and range from 8 to 250 acres in size.

This soil has a surface layer that is about 10 inches thick (fig. 8). The layer is friable, moderately alkaline, dark grayish brown fine sandy loam. The layer below that extends to a depth of 28 inches. It is friable, moderately alkaline sandy clay loam that is dark brown in the upper 5 inches and pale brown in the lower 13 inches. To a depth of 44 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam that is about 20 to 25 percent, by volume, soft masses and concretions of calcium carbonate. And to a depth of 61 inches, the soil is friable, moderately alkaline, very pale brown sandy clay loam that is about 5 to 10 percent, by volume, concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Goliad, Olmos, Pettus, and Runge soils and a few areas that have slopes of as much as 8 percent. These areas are gullied in places. The included soils make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. The soil can be droughty, and forage production is medium. In a few areas it is cultivated to grain sorghum. Because of the high content of calcium carbonate of the soil, the available iron and phosphorus are ineffective, and some crops, particularly grain sorghum, may be chlorotic.

The potential for cotton and grain sorghum is low. A cropping system should be used that helps control erosion and improve or maintain soil productivity and tilth. Crops that produce large amounts of residue are needed. Residue returned to surface helps increase the water intake rate and helps prevent erosion. Terraces and contour farming help control erosion and conserve moisture. Grassed waterways and diversion terraces can be used to help control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is high.

Capability subclass IIIe; Gray Sandy Loam range site.

34—Pernitas sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Areas of the soil are irregular to oval in shape and range from 20 to several hundred acres in size.

Figure 8.—Profile of Pernitas fine sandy loam, 1 to 5 percent slopes.

This soil has a surface layer that is about 11 inches thick. The layer is friable, moderately alkaline, dark gray sandy clay loam. Below that, to a depth of 30 inches, the soil is friable, moderately alkaline clay loam that is grayish brown in the upper 6 inches and brown in the lower 13 inches. To a depth of 72 inches, the soil is friable, moderately alkaline clay loam that is light brown and is about 20 to 25 percent, by volume, soft masses and concretions of calcium carbonate in the upper 6 inches and pinkish gray and about 15 to 20 percent, by volume, soft masses of calcium carbonate in the lower 36 inches.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Olmos, Runge, Pettus, and Pharr soils. Also included are areas of a soil that is similar to Pernitas soils except that the surface layer is noncalcareous. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and rangeland. Grain sorghum and flax are the main crops.

The potential for cotton, grain sorghum, and flax is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Contour farming and crop residue returned to the surface help conserve moisture and prevent erosion. Grassed waterways and diversion terraces may be needed to help control runoff.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is medium because the surface texture is too clayey.

Capability subclass IIc; Gray Sandy Loam range site.

35—Pernitas sandy clay loam, 1 to 5 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is convex. Areas are irregular to oval in shape and range from 20 to several hundred acres in size.

This soil has a surface layer that is about 11 inches thick. The layer is friable, moderately alkaline, dark grayish brown sandy clay loam. Below that, to a depth of 18 inches, the soil is friable, moderately alkaline, dark brown sandy clay. To a depth of 32 inches, it is friable, moderately alkaline, brown clay. Below that, to a depth of 72 inches, the soil is friable, moderately alkaline, brown sandy clay loam that is about 30 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Olmos, Pettus, Pharr, and Runge soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. It is erodible if disturbed, and it is droughty.

The potential for cotton and grain sorghum is low. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce much residue are needed. Residue returned to the surface helps increase the water intake rate and helps prevent erosion. Terraces and contour farming are needed. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, seepage, and low strength are the main limitations. The potential for recreation uses is medium because the surface layer is too clayey.

Capability subclass IIIe; Gray Sandy Loam range site.

36—Pernitas sandy clay loam, gullied. This is a deep, gently sloping to sloping soil on uplands. The surface is convex. Slopes range from 1 to 8 percent. Gullies range from about 2 feet deep and 2 feet wide at their origin to about 10 feet deep and 20 feet wide where they enter the major drainageways, and they are 150 feet to 1,320 feet long. These gullies are 20 to 500 feet apart. Areas of this soil are irregular to oblong in shape and range from 4 to 100 acres in size.

This soil has a surface layer that is about 10 inches thick. The layer is friable, moderately alkaline, dark gray sandy clay loam. Below that, to a depth of 15 inches, the soil is firm, moderately alkaline, brown sandy clay loam. To a depth of 29 inches, it is firm, moderately alkaline, light brown clay loam. And to a depth of 72 inches, the soil is firm, moderately alkaline, pale brown loam that is about 10 to 15 percent, by volume, soft masses of calcium carbonate in the upper 9 inches and about 40 to 50 percent masses of calcium carbonate in the lower 34 inches.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate to severe. Erosion on this soil mainly causes gullies.

Included in mapping are small areas of Opelika, Pettus, Pharr, and Sinton soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas, the land has been shaped and the soil seeded to buffelgrass.

This soil should not be used as cropland.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is medium because the surface layer is too clayey.

Capability subclass VIe; Gray Sandy Loam range site.

37—Pettus sandy clay loam, 0 to 3 percent slopes. This is a shallow, nearly level to gently sloping soil on uplands. The surface is slightly concave to slightly convex. Areas are irregular to oval in shape and range from 5 to 75 acres in size.

This soil has a surface layer that is about 10 inches thick. The layer is very friable, moderately alkaline, grayish brown sandy clay loam. Below that, to a depth of 17 inches, the soil is friable, moderately alkaline, light brownish gray sandy clay loam. To a depth of 21 inches, it is white, weakly cemented, platy, and fractured caliche that has interstices, root channels, and solution channels filled with light brownish gray sandy clay loam material. And to a depth of 65 inches, the soil is white, gravelly sandy clay loam that is about 60 percent soft masses and nodular concretions of calcium carbonate up to 2 centimeters wide.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate.

Included in mapping are small areas of Olmos and Pernitas soils and small areas of rock outcrops. Also included are areas of a soil that is similar to Pettus soils except that the surface layer is lighter in color. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. Because this soil is droughty, crop yields are low in most years. This soil is erodible if disturbed.

The potential for grain sorghum is low. A cropping system should be used that helps control erosion, conserve moisture, and maintain or improve soil productivity and tilth. Crops that produce large amounts of residue are needed. Residue returned to the surface helps increase the water intake rate and helps prevent erosion. Diversion terraces and grassed waterways help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of short and mid grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Corrosivity to steel, seepage, a cemented pan, and low strength are the limitations. The potential for recreation uses is medium because the surface texture is too clayey.

Capability subclass IIIe; Shallow range site.

38—Pettus sandy clay loam, 3 to 5 percent slopes. This is a shallow, gently sloping soil on uplands. The

surface is convex. Areas are irregular to oblong in shape and range from 10 to 150 acres in size.

This soil has a surface layer that is about 8 inches thick. The layer is friable, moderately alkaline, dark brown sandy clay loam. Below that, to a depth of 14 inches, the soil is friable, moderately alkaline, grayish brown sandy clay loam. The underlying material in the upper 4 inches is white, moderately cemented caliche; below that, it is weakly cemented, fractured caliche.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate.

Included in mapping are small areas of Olmos and Pernitas soils and small areas of rock outcrops. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. Because this soil is droughty, crop yields are low in most years. This soil is erodible if disturbed.

The potential for grain sorghum is low. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce large amounts of residue are needed. Residue returned to the surface helps increase the water intake rate and helps prevent erosion. Terraces and contour farming help conserve moisture and prevent erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of short and mid grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Corrosivity to steel, seepage, a cemented pan, and low strength are the limitations. The potential for recreation uses is medium because of slope and the clayey surface layer.

Capability subclass IVe; Shallow Ridge range site.

39—Pettus sandy clay loam, gullied. This is a shallow, gently sloping to sloping soil on uplands. The surface is convex. Slopes range from 3 to 8 percent. Gullies range from 2 feet deep and 2 feet wide near their origin at the upper part of slopes to 30 feet deep and 30 feet wide at the base of the slopes. They are 50 to 1,500 feet apart. Areas are irregular to oblong in shape and range from 5 to 100 acres in size.

The surface layer is about 7 inches thick. It is friable, moderately alkaline, dark grayish brown sandy clay loam that is about 5 to 10 percent, by volume, concretions of calcium carbonate. Below that, to a depth of 12 inches, the soil is friable, moderately alkaline, brown sandy clay loam that is about 10 percent, by volume, concretions of calcium carbonate. Below that, to a depth of 20 inches, it is white, weakly cemented caliche that has interstices and solution channels filled with brown sandy clay loam material. The underlying material, to a depth of 48 inches, is friable, moderately alkaline, light gray sandy clay loam that is about 20 percent, by volume, concretions of calcium carbonate up to 3 centimeters wide.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow. The hazard of water erosion is moderate to severe. Sheet and gully erosion have altered 25 to 50 percent of the soil area, leaving remnants of the Pettus soil. These areas commonly do not have any vegetation, and the soil surface is partly covered by concretions of calcium carbonate, most of which are less than 2 centimeters wide.

Included in mapping are small areas of eroded Olmos, Pernitas, and Pharr soils. These inclusions make up less than 15 percent of any mapped area.

This soil is used mostly as rangeland. It is not suitable for use as cropland. Because the soil is droughty, eroded areas are difficult to revegetate.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of short and mid grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Corrosivity to steel, seepage, a cemented pan, gullies, and low strength are the limitations. The potential for recreation uses is medium because of slope and the clayey surface layer.

Capability subclass VIe; Shallow range site.

40—Pharr fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Areas are irregular to oblong in shape and range from 5 to 200 acres in size.

This soil has a surface layer that is about 18 inches thick. The layer is very friable, moderately alkaline, dark grayish brown fine sandy loam. Below that, to a depth of 35 inches, the soil is friable, moderately alkaline, grayish brown sandy clay loam. To a depth of 46 inches, it is firm, moderately alkaline, pale brown sandy clay loam. And to a depth of 60 inches, the soil is firm, moderately alkaline, pale brown sandy clay that is about 3 to 5 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Czar, Opelika, and Racombes soils and areas of Pharr soils that have slopes of more than 1 percent. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland or improved pasture of buffelgrass and coastal bermudagrass. Cotton and grain sorghum are the main crops. Because of the high content of calcium carbonate of this soil, the available iron and phosphorus are ineffective, and some crops, particularly grain sorghum, may be chlorotic.

The potential for cotton and grain sorghum is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Crop residue returned to the surface helps reduce soil temperatures and slow the loss of water by evaporation. Grassed waterways and diversion terraces help to control excess water. Contour farming helps conserve moisture and prevent erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is high. Corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is high.

Capability subclass IIc; Gray Sandy Loam range site.

41—Pharr fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas are irregular to oval in shape and range from 5 to 150 acres in size.

This soil has a surface layer that is about 9 inches thick. The layer is very friable, moderately alkaline, dark grayish brown fine sandy loam. Below that, to a depth of 33 inches, the soil is friable, moderately alkaline, grayish brown sandy clay loam. To a depth of 45 inches, it is friable, moderately alkaline, pale brown sandy clay loam that is about 5 percent, by volume, soft masses and concretions of calcium carbonate. And to a depth of 65 inches, the soil is firm, moderately alkaline, very pale brown clay loam that is about 10 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Czar, Pettus, Racombes, and Runge soils. Also included are areas of Pharr soils that have slopes of less than 1 percent or a sandy clay loam surface layer. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland or improved pastures of buffelgrass and coastal bermudagrass. In a few areas it is cultivated to cotton and grain sorghum. Because of the high content of calcium carbonate of this soil, the available iron and phosphorus are ineffective, and crops, particularly grain sorghum, may be chlorotic.

The potential for cotton is high, and the potential for grain sorghum is medium. A cropping system should be used that helps conserve moisture and improve or maintain soil productivity and tilth. Crops that produce much residue should be used. Residue returned to the surface helps to prevent runoff, increase the water intake rate, and reduce erosion. Terraces and farming on the contour help prevent erosion. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is high. Corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is high.

Capability subclass IIe; Gray Sandy Loam range site.

42—Pharr sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is plane to slightly convex. Areas are irregular to oblong in shape and range from 15 to 275 acres in size.

This soil has a surface layer that is about 10 inches thick. The layer is friable, moderately alkaline sandy clay loam that is grayish brown in the upper 6 inches and dark gray in the lower 4 inches. Below that, to a depth of 40 inches, the soil is friable, moderately alkaline sandy clay loam that is grayish brown in the upper 8 inches and pale brown in the lower 22 inches. To a depth of 50 inches, it is friable, moderately alkaline, pale brown sandy clay loam that is about 2 to 3 percent, by volume, soft masses of calcium carbonate. And to a depth of 65 inches, the soil is friable, moderately alkaline, very pale brown and brown sandy clay loam that is about 5 to 10 percent, by volume, soft masses of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Clareville, Czar, Opelika, Pernitas, and Racombes soils and areas of Pharr soils that have slopes of more than 1 percent. These inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland, rangeland, and improved pasture of buffelgrass and coastal bermudagrass. Cotton and grain sorghum are the main crops.

The potential for cotton and grain sorghum is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Crop residue returned to the surface helps reduce soil temperature and slow the loss of water by evaporation. Contour farming helps conserve moisture. Grassed waterways and diversion terraces help to remove excess water.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is high. Corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is medium.

Capability subclass IIe; Gray Sandy Loam range site.

43—Pharr sandy clay loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas are irregular to oblong in shape and range from 5 to 100 acres in size.

This soil has a surface layer that is about 15 inches thick. The layer is very friable, moderately alkaline, dark grayish brown sandy clay loam. Below that, to a depth of 33 inches, the soil is friable, moderately alkaline, grayish brown sandy clay loam. To a depth of 44 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam. And to a depth of 60 inches, the soil is friable, moderately alkaline, pale brown sandy clay loam that is about 3 to 6 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Czar, Pettus, Pernitas, and Racombes soils and areas of Pharr soils that have slopes of less than 1 percent. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland or improved pasture of buffelgrass and coastal bermudagrass.

The potential for cotton is high, and the potential for grain sorghum is medium. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crops that produce much residue should be used. Residue returned to the surface increases the water intake rate and helps reduce erosion. Terraces and farming on the contour help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is high. Corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is medium.

Capability subclass IIe; Gray Sandy Loam range site.

44—Pits. Pits are open excavations from which caliche or material for fill has been removed. The caliche pits are mainly in areas of the Olmos association and in areas of Pernitas and Parrita soils. The borrow pits are scattered throughout the county. Pits range from 1 to 97 acres in size. The average size is about 10 acres.

Most of the acreage of this map unit is not suitable for farming. Some abandoned pits can be used for limited grazing or wildlife habitat if they are smoothed and seeded to grasses or other suitable vegetation.

Capability subclass not assigned.

45—Racombes sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is slightly concave. Areas are irregular to oblong in shape and range from 20 to 150 acres in size.

This soil has a surface layer that is about 11 inches thick. The layer is friable, neutral, very dark gray sandy clay loam. The layer below that, to a depth of 41 inches, is firm, neutral sandy clay loam; it is dark grayish brown in the upper 12 inches and brown in the lower 18 inches. To a depth of 76 inches, the soil is firm, moderately alkaline, light brown sandy clay loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep. The hazard of water erosion is slight. This soil receives runoff from soils on adjacent uplands in most years and is occasionally flooded during heavy rainfall.

Included in mapping are small areas of Clareville, Czar, Opelika, and Papagua soils. Also included are areas of a soil that is similar to this Racombes soil except that the surface layer is thinner. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as cropland and rangeland. Cotton and grain sorghum are the main crops.

The potential for cotton and grain sorghum is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Terraces and farming on the contour help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to remove excess water.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Shrinking and swelling of the soil with changes in moisture content, corrosivity to steel, seepage, and low strength are the limitations. The potential for recreation uses is medium because of the clayey surface layer.

Capability subclass IIc; Clay Loam range site.

46—Runge fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is slightly convex. Areas are irregular to oval in shape and range from 10 to 200 acres in size.

This soil has a surface layer that is about 14 inches thick. The layer is very friable, slightly acid fine sandy loam that is dark grayish brown in the upper 6 inches and dark brown in the lower 8 inches. Below that, to a depth of 19 inches, the soil is very friable, neutral, dark brown sandy clay loam. To a depth of 36 inches, it is friable, mildly alkaline, reddish brown sandy clay loam. Below that, to a depth of 54 inches, it is friable, moderately alkaline, yellowish red sandy clay loam. And to a depth of 65 inches, the soil is friable, moderately alkaline, pink sandy clay loam that is about 3 to 5 percent, by volume, soft masses of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high.

The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Czar, Delfina, and Racombes soils and areas of Runge soils that have slopes of more than 1 percent. Also included are areas of a soil that is similar to this Runge soil except that the subsoil has gray mottles. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas it is cultivated to cotton and grain sorghum.

The potential for cotton is medium, and the potential for grain sorghum is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Contour farming and crop residue that is returned to the surface help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to control runoff.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Corrosivity to steel, the shrink-swell potential, and low strength are the limitations. The potential for recreation uses is high.

Capability subclass IIc; Sandy Loam range site.

47—Runge fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas are irregular in shape and range from 40 to 300 acres in size.

This soil has a surface layer that is about 14 inches thick (fig. 9). The layer is very friable, neutral, brown fine sandy loam. Below that, to a depth of 18 inches, the soil is friable, neutral, reddish brown sandy clay loam. To a depth of 34 inches, it is friable, mildly alkaline, yellowish red sandy clay loam. Below that, to a depth of 55 inches, it is friable, moderately alkaline, reddish yellow sandy clay loam. And to a depth of 72 inches, the soil is friable, moderately alkaline, reddish yellow sandy clay loam that is about 5 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Czar, Delfina, and Goliad soils and areas of Runge soils that have slopes of less than 1 percent. Also included are areas of a soil that is similar to this Runge soil except that the subsoil has gray mottles. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas it is cultivated to cotton and grain sorghum.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce much residue are needed. Residue should be returned to the surface. Terraces and contour farming help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Corrosivity to steel, the shrink-swell potential, and low strength

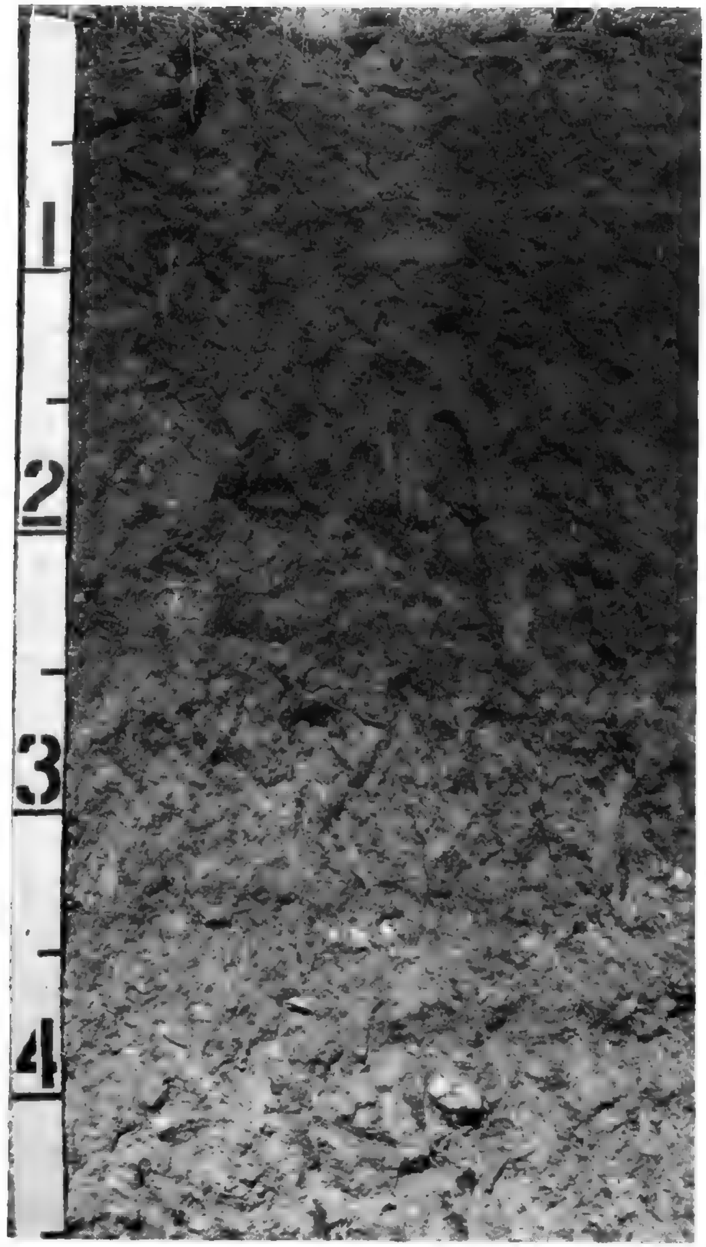

Figure 9.—Profile of Runge fine sandy loam, 1 to 3 percent slopes.

are the limitations. The potential for recreation uses is high.

Capability subclass IIe; Sandy Loam range site.

48—Runge fine sandy loam, 3 to 5 percent slopes. This is a deep, gently sloping soil on uplands. The surface is convex. Areas are oval in shape and range from 7 to 45 acres in size.

This soil has a surface layer about 12 inches thick. It is very friable, slightly acid, brown fine sandy loam. Below that, to a depth of 19 inches, the soil is very friable, neutral, reddish brown sandy clay loam. To a depth of 35 inches, it is friable, mildly alkaline, yellowish red sandy clay loam. Below that, to a depth of 50 inches, it is friable, moderately alkaline, reddish yellow sandy clay loam. And to a depth of 75 inches, the soil is friable, moderately alkaline, pink and light brown sandy clay loam that is about 5 to 7 percent, by volume, soft masses and concretions of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Czar and Goliad soils and areas of less sloping Runge soils. Also included are areas of a soil that is similar to this Runge soil except that the subsoil has gray mottles. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland and improved pasture of buffelgrass or coastal bermudagrass.

The potential for cotton is low, and the potential for grain sorghum is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce much residue are needed. Residue should be returned to the surface. Terraces and contour farming help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to control erosion.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Corrosivity to steel, the shrink-swell potential, and low strength are the most limiting features. The potential for recreation uses is high.

Capability subclass IIIe; Sandy Loam range site.

49—Runge sandy clay loam, 0 to 1 percent slopes. This is a deep, nearly level soil on uplands. The surface is slightly convex. Areas are irregular to oblong in shape and range from 10 to 100 acres in size.

This soil has a surface layer that is about 12 inches thick. The layer is friable, moderately alkaline, dark brown sandy clay loam. Below that, to a depth of 38 inches, the soil is friable, moderately alkaline sandy clay loam that is dark brown in the upper 7 inches and yellowish red in the lower 19 inches. The layer between depths of 38 and 70 inches is friable, moderately alkaline sandy clay loam; it is brown and 25 to 50 percent, by volume, soft masses and concretions of calcium carbonate in the upper 15 inches; and it is pink and about 30 percent, by volume, soft masses and concretions of calcium carbonate in the lower 17 inches.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Goliad, Parrita, Pernitas, and Pharr soils. Also included are areas of a soil that is similar to this Runge soil except that the subsoil has gray mottles. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas it is cultivated to grain sorghum.

The potential for cotton is medium, and the potential for grain sorghum is high. A cropping system should be used that helps conserve moisture and maintain or improve soil productivity and tilth. Crop residue should be returned to the surface. Terraces and farming on the contour help conserve moisture and prevent erosion. Grassed waterways and diversion terraces help to control runoff.

The potential for native range plants is medium. In favorable years, this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Corrosivity to steel, the shrink-swell potential, and low strength are the limitations. The potential for recreation uses is medium because of the clayey surface layer.

Capability subclass IIc; Sandy Loam range site.

50—Runge sandy clay loam, 1 to 3 percent slopes. This is a deep, gently sloping soil on uplands. The surface is slightly convex. Areas are irregular in shape and range from 20 to 100 acres in size.

This soil has a surface layer that is about 12 inches thick. The layer is very friable, mildly alkaline, dark grayish brown sandy clay loam. Below that, to a depth of 18 inches, the soil is friable, moderately alkaline, brown sandy clay loam. To a depth of 30 inches, it is firm, moderately alkaline, reddish brown sandy clay loam. Below that, to a depth of 42 inches, it is firm, moderately alkaline, yellowish red sandy clay loam. And to a depth of 75 inches, the soil is firm, moderately alkaline, brown sandy clay loam that is about 7 to 8 percent, by volume, soft masses of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. The hazard of water erosion is moderate.

Included in mapping are small areas of Goliad, Parrita, Pernitas, and Pharr soils. Also included are areas of a soil that is similar to this Runge soil except that the subsoil has gray mottles. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas it is used as improved pasture of buffelgrass.

The potential for cotton and grain sorghum is medium. A cropping system should be used that helps control erosion and maintain or improve soil productivity and tilth. Crops that produce much residue should be used in the cropping system. Residue should be returned to the surface. Terraces and contour farming help control erosion. Grassed waterways are needed to help control erosion.

The potential for native range plants is medium. In favorable years this soil produces moderate yields of mid and tall grasses. The potential for wildlife habitat is high.

The potential for most urban uses is medium. Corrosivity to steel, the shrink-swell potential, and low strength are the limitations. The potential for recreation uses is medium because the surface texture is too clayey.

Capability subclass IIe; Sandy Loam range site.

51—Sarita loamy fine sand, 0 to 5 percent slopes. This is a deep, nearly level to gently sloping soil on uplands. The surface is concave to convex. Areas are oval to oblong in shape and range from 30 to 250 acres in size.

This soil has a surface layer that is about 63 inches thick. The layer is very friable, neutral, light brownish gray loamy fine sand in the upper 9 inches and very friable, neutral, pale brown fine sand in the lower 54 inches. Below that, to a depth of 70 inches, the soil is friable, slightly acid, light yellowish brown fine sandy loam that has brownish mottles. To a depth of 80 inches, it is friable, slightly acid, pale brown sandy clay loam that has brownish and grayish mottles.

This soil is well drained. Runoff is slow to very slow. Permeability is moderately rapid, and the available water capacity is low. The root zone is deep. The hazard of water erosion is slight.

Included in mapping are small areas of Leming and Papalote soils and areas of Sarita soils that have slopes of more than 5 percent. Also included are areas of a soil that is similar to this Sarita soil except that it has a sandy layer more than 80 inches thick. The included soils make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. In a few areas it is used for improved pasture of coastal bermudagrass.

The potential for watermelons and peanuts is medium. A cropping system should be used that helps to control erosion. Crops should be planted that produce much residue and improve the soil. Crop residue should be returned to the surface. Stripcropping helps control wind erosion.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is medium.

The potential for most urban uses is medium. Moderately rapid permeability, low strength, corrosivity to steel, and the hazard of cutbanks caving are the limitations. The potential for recreation uses is low because of the sandy surface.

Capability subclass IVe; Sandy range site.

52—Sinton sandy clay loam. This is a deep, nearly level soil on flood plains. The surface is slightly concave. Slopes range from 0 to 1 percent. Areas of the soil are irregular in shape and range from 15 to 300 acres in size.

This soil has a surface layer that is about 34 inches thick. The layer is friable, moderately alkaline sandy clay loam that is very dark gray in the upper 10 inches and dark gray in the lower 24 inches. Below that, to a depth of 65 inches, the soil is friable, moderately alkaline, stratified sandy clay loam that is light brownish gray in the upper 16 inches and light gray in the lower 15 inches.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep. The hazard of water erosion is slight. This soil is commonly flooded for brief periods following heavy rains, mainly in spring and fall.

Included in mapping are small areas of Aransas, Czar, Pharr, and Racombes soils. These inclusions make up less than 15 percent of any one mapped area.

This soil is used mostly as rangeland. It should not be used as cropland because of the flood hazard.

The potential for native range plants is high. In favorable years, this soil produces good yields of mid and tall grasses. The potential for wildlife habitat is low.

The potential for most urban uses is low. Flooding and corrosivity to steel are the limitations. The potential for recreation uses is medium because of flooding.

Capability subclass IIw; Loamy Bottomland range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity,

potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops, pasture, and rangeland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the predicted yields of the main crops and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms, should also consider the detailed information given in the description of each soil.

In 1967, more than 218,000 acres in the survey area was used for crops and pasture. Of this total, 104,000 acres was used for permanent pasture; 91,000 acres, for row crops, mainly grain sorghum; 10,000 acres, for close-grown crops, mainly flax; and 13,000 acres, for rotation hay and pasture.

About 50,000 acres of soils that have good potential for use as cropland is currently used for pasture. Food production could be increased considerably by using this reserve productive capacity and by extending the lastest crop production technology to all cropland in the survey area.

Acreage in crops and pasture has gradually been decreasing as more land is used for urban development. In 1967, an estimated 14,000 acres was urban and built-up land. The use of this soil survey to help make decisions on land use in the county is discussed in the section "Soil maps for general planning."

The main management concern in Jim Wells County is the hazard of water erosion. Water erosion is a hazard on the loamy and clayey, gently sloping Czar, Danjer, Delfina, Delmita, Goliad, Lacoste, Lattas, Miguel, Papalote, Pernitas, Pettus, Pharr, and Runge soils. Vegetative cover, contour farming, terraces, and grassed waterways can help minimize water erosion on these soils.

Loss of the surface layer through erosion is damaging to the soil because productivity is reduced as the surface layer is lost and part of the subsoil is mixed into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, for example, Leming, Miguel, and Papalote soils, and on soils that have a layer in or below the subsoil that limits the depth of the root zone. For example, the Delmita, Goliad, Lacoste, Olmos, Parrita, and Pettus soils have an indurated caliche layer.

Erosion also reduces productivity on soils that tend to be droughty, for example, Delmita, Goliad, Lacoste, Olmos, Parrita, and Pettus soils.

Water erosion on farmland also causes sediment to enter streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils.

Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but they are more difficult to use successfully on the eroded soils and on the soils that have a clayey surface layer, for example, Aransas, Danjer, Edroy, and Lattas soils.

Contour farming is best adapted to soils that have smooth, uniform slopes, including most areas of the gently sloping Czar, Danjer, Delfina, Delmita, Edroy,

Goliad, Lattas, Miguel, Papalote, Pernitas, Pettus, Pharr, and Runge soils.

Grassed waterways minimize soil erosion by concentrating runoff. They can also serve as outlets for terraces or diversions.

Terraces and diversions reduce the length of slope and help control runoff and erosion. They are most practical on deep, well drained soils that have smooth, uniform slopes, for example, the Czar, Delfina, and Runge soils. Other soils are less suited to terraces and diversions. For example, Papalote soils have a clayey subsoil that would be exposed in terrace channels, Pharr soils contain high concentrations of calcium carbonate at a depth of less than 30 inches, Danjer and Lattas soils are moderately well drained to somewhat poorly drained, and Delmita, Goliad, Lacoste, Parrita, and Pettus soils have indurated caliche at a depth of less than 30 inches.

Information on the design of erosion control practices for each kind of soil is available at local offices of the Soil Conservation Service.

Soil drainage is a major management need on the Aransas and Edroy soils. Diversion terraces and field and lateral drainage ditches can increase yields.

The fertility of most of the cultivated soils is naturally medium to high. Additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help to determine the kind and amount of fertilizer to apply. None of the soils in the county need additions of lime.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops have a surface layer of fine sandy loam or sandy clay loam that is light in color and low in content of organic matter. Generally, the structure is weak, and intense rainfall causes a crust to form on the surface. The crust is hard when dry and nearly impervious to water. It reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help to improve soil structure and to reduce crust formation.

Because the Aransas, Danjer, Edroy, and Lattas soils are clayey, tilth is a problem. If these soils are wet when plowed, they are very cloddy when they dry, and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in spring.

The soils and climate of the survey area are suited to field crops that are not now commonly grown. Corn and, to an increasing extent, soybeans are the row crops that could be grown. Grain sorghum, sunflowers, navy beans, sugar beets, peanuts, and potatoes also could be grown.

The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Irrigation

In 1974, about 3,000 acres of cropland and 3,200 acres of pasture were irrigated in Jim Wells County. The largest irrigated area is in the community of Premont.

All water used for irrigation is pumped from wells. Because of the sandy surface texture of the soils, sprinkler irrigation systems are used.

Yields of irrigated crops are 1 to 3 times more than yields of nonirrigated crops.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties are also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 6.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about

the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use. (None in the county.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production. (None in the county.)

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 7. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

Rangeland

John E. Roberts, district conservationist, Soil Conservation Service, helped prepare this section.

Rangeland supports a natural potential plant community that consists of grasses, forbs, and shrubs that are used for grazing. About 303,750 acres in the survey area was used as rangeland in 1967 (*7*).

Acreage in rangeland has gradually decreased over the years. There are about 600 farms and ranches producing livestock in the county. For the purpose of this survey, a ranch has 750 acres or more in rangeland and an income based mainly on livestock. There are about 52 ranches in the county that meet these criteria. The ranches are 750 to 42,000 acres in size. The average size is 1,500 acres.

Cow-calf operations are the dominant type of livestock enterprise in the county.

The native vegetation in many parts of the county has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush, weeds, and cactus. The amount of forage produced may be less than half of what was originally produced.

In areas that have similar climate and topography, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 8 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of grasses, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 8.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. The relationship between soils and vegetation was established during the survey; thus range sites generally can be determined directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the northeastern part of the county, most of the soils are clay loam, gravelly loam, sandy clay loam, and sandy loam that are shallow to moderately deep over indurated caliche. In a favorable year, the shallow soils produce low to moderate yields of short and mid grasses, and the moderately deep soils produce moderate to high yields of mid and tall grasses. The production potential of the shallow soils is limited because of the shallow root zone and the low available water capacity.

In the west-central part of the county, most of the soils are deep fine sandy loam and sandy clay loam. These soils produce moderate yields of mid and tall grasses in a favorable year. The production potential of these soils is limited by a medium available water capacity.

In the southeastern part of the county, most of the soils are deep fine sandy loam and loamy fine sand. These soils produce moderate to high yields of mid and tall grasses in a favorable year.

Growth of native vegetation is greatest in May and June when rainfall and temperature are favorable for growth. Conditions are also favorable for growth in September and October.

The main management concern on most of the rangeland is the control of grazing so that the kinds and amounts of plants that make up the potential plant community are maintained or re-established. Another major concern is brush management. Because of overgrazing, brush invasion has become a problem on most of the rangeland.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between soil properties and behavior of the soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations are also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the large scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil are included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitation that affects shallow excavations, dwellings with and without a basement, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use and that limitations are minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils that are rated severe, costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a

flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special design, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard if the seasonal high water table is above the level of the lagoon floor. If the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the site should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plant life. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plant life is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salts; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site

features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 14, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bristlegrass, lovegrass, bromegrass, clover, and switchgrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are hackberry, spiny hackberry, wild plum, black brush, and honey locust.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, dove, meadowlark, field sparrow, cottontail rabbit, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, and kingfishers.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include white-tailed deer, jackrabbit, coyote, dove, meadowlark, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in-place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

G.P. Johnson, Jr., engineer, Soil Conservation Service, helped prepare this section.

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 in the standard terms used by the U.S. Department of Agriculture (*8*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the suitability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 18. The estimated classification, without group index numbers, is given in table 15. Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 16. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 18.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Texas State Department of Highways and Public Transportation.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-66T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and shrinkage (D-427).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders.

The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Argiustolls (*Arg*, meaning argillic horizons, plus *Ustoll*, the suborder of Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, hyperthermic, Typic Argiustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*8*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Aransas series

The Aransas series consists of deep, clayey soils on bottom lands. These soils formed in calcareous, clayey sediment of alluvial origin. Slopes range from 0 to 1 percent.

Typical pedon of Aransas clay, frequently flooded; from the intersection of Texas Highway 359 and the Nueces River on the Jim Wells-San Patricio County line, about 0.2 mile southwest on Texas Highway 359, and 300 feet northwest of highway right-of-way in pasture:

A11—0 to 2 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine and medium blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; few worm casts; common pressure faces on peds; calcareous; moderately alkaline; clear smooth boundary.

A12—2 to 22 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few snail shell fragments; many pressure faces on peds; calcareous; moderately alkaline; gradual wavy boundary.

A13—22 to 40 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few small slickensides; few soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

C—40 to 65 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine distinct strong brown mottles in lower part; massive; extremely hard, very firm, sticky and plastic; few old cracks filled with dark gray (10YR 4/1) material in upper part; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 35 to 50 inches thick. Cracks up to 1 inch wide extend into the upper part of the C horizon when the soil is dry.

The A horizon is very dark gray or dark gray.

The C horizon is gray or light gray.

Clareville series

The Clareville series consists of deep, loamy soils that formed in ancient alluvial deposits on uplands. Slopes range from 0 to 1 percent.

Typical pedon of Clareville loam, 0 to 1 percent slopes; from the intersection of Texas Highway 359 and Farm Road 624 in Orange Grove, about 1.55 miles southwest on Texas Highway 359 to gas pipeline marker, and 390 feet east in cultivated field:

Ap—0 to 5 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, slightly sticky; few fine roots; neutral; abrupt smooth boundary.

A1—5 to 11 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak fine subangular blocky structure; hard, friable, sticky; few fine roots; few fine pores; neutral; clear smooth boundary.

B21t—11 to 18 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky; few fine roots; many fine pores; few clay films; mildly alkaline; gradual smooth boundary.

B22t—18 to 25 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky; few fine roots; many fine pores; evident clay films; few worm casts; mildly alkaline; gradual wavy boundary.

B23t—25 to 33 inches; brown (10YR 5/3) clay loam; dark brown (10YR 4/3) moist; moderate medium blocky structure; very hard, very firm, sticky; many fine pores; evident clay films; few soft masses of calcium carbonate; few worm casts; calcareous; moderately alkaline; gradual wavy boundary.

B3—33 to 38 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; very hard, very firm, sticky; many worm casts; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cca—38 to 46 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky; about 20 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—46 to 64 inches; very pale brown (10YR 8/3) loam, very pale brown (10YR 7/3) moist; massive; hard, friable; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 30 to 60 inches thick. The mollic epipedon is 20 to 36 inches thick.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark brown, or dark grayish brown. It is loam, sandy clay loam, or clay loam. It is neutral or mildly alkaline.

The B2t horizon is dark grayish brown, very dark grayish brown, dark brown, grayish brown, or brown. It is neutral or mildly alkaline in the upper part and moderately alkaline in the lower part. It is clay, clay loam, or sandy clay.

The B3 horizon is brown, grayish brown, pale brown, or gray. It is clay loam or sandy clay.

The C horizon is pale brown, very pale brown, light brownish gray, or white.

Comitas series

The Comitas series consists of deep, sandy soils that formed in sandy and loamy sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Comitas loamy fine sand, 0 to 3 percent slopes; from the intersection of Farm Road 70 and Texas Highway 359 in Sandia, about 4.6 miles southeast on Farm Road 70, 1.2 miles northeast on paved road, and 50 feet northwest in improved pasture:

Ap—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose, very friable; common fine roots; slightly acid; clear smooth boundary.

A1—7 to 32 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; few fine faint brownish yellow mottles; weak fine and medium subangular blocky structure; slightly hard, very friable; few fine roots; neutral; gradual smooth boundary.

B2t—32 to 55 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few fine faint yellowish brown mottles; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; thin patchy clay films on faces of peds; mildly alkaline; gradual wavy boundary.

B3—55 to 62 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; few fine faint yellowish brown mottles; weak fine subangular blocky structure; slightly hard, very friable; few fine soft masses of calcium carbonate; moderately alkaline; clear wavy boundary.

Cca—62 to 75 inches; very pale brown (10YR 7/4) fine sandy loam, pale brown (10YR 6/3) moist; few fine faint grayish brown mottles; massive; slightly hard, very friable; few fine soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 55 to 75 inches thick.

The A horizon is grayish brown, dark grayish brown, or brown. It is slightly acid or neutral.

The B2t horizon is brown, pale brown, light brown, or reddish brown. In some pedons it has faint mottles of brownish yellow or yellowish brown. This horizon is fine sandy loam or sandy clay loam. It ranges from neutral through moderately alkaline.

The B3 horizon is brown, pale brown, light brown, or reddish brown. It is fine sandy loam or sandy clay loam.

The C horizon is very pale brown, pale brown, pink, or light reddish brown. It is fine sandy loam or sandy clay loam. It is 2 to 5 percent soft masses of calcium carbonate.

Czar series

The Czar series consists of deep, loamy soils that formed in calcareous loamy sediment on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Czar fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 141 south of Alice, about 1.6 miles south on U.S. Highway 281, 0.3 mile west through ranch gate, 0.3 mile north along power line, and 50 feet east of power line in pasture:

A11—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; common horizontal streaks of brown (10YR 5/3) sand grains; neutral; abrupt smooth boundary.

A12—3 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and weak fine subangular blocky structure; hard, friable; common fine roots; few fine pores; few worm casts; neutral; clear smooth boundary.

B21t—13 to 22 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few fine pores; thin patchy clay films on faces of peds; moderately alkaline; clear smooth boundary.

B22t—22 to 34 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; few fine roots; few fine pores; many patchy clay films on vertical faces of prisms and on peds; few insect and animal burrows filled with dark brown (10YR 4/3) material; moderately alkaline; gradual smooth boundary.

B3ca—34 to 47 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; few fine pores; 1 to 2 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—47 to 68 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; 3 to 4 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 55 inches thick. Secondary lime is at a depth of 20 to 36 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon is very dark grayish brown, dark gray, dark grayish brown, or grayish brown. It is neutral or mildly alkaline.

The B2t horizon is dark grayish brown, dark brown, grayish brown, or brown. It is sandy clay loam or fine sandy loam. It is mildly alkaline or moderately alkaline.

Some pedons have a B3 horizon that is brown, pale brown, light brown, or light brownish gray. Soft masses and concretions of calcium carbonate range from 1 to 5 percent.

The Cca horizon is pale brown, very pale brown, pink, or white. Soft masses and concretions of calcium carbonate range from 3 to 15 percent, by volume.

Danjer series

The Danjer series consists of deep, clayey soils that formed in calcareous clayey sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Danjer clay, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 359 in Alice, about 13.0 miles north on U.S. Highway 281, 0.75 mile east on caliche road, and 40 feet south of road in cultivated field in a microdepression:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common fine roots; few fine patches of uncoated sand grains; few fragments of snail shell; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; very hard, very firm, sticky and plastic; few fine roots; many pressure faces on peds; few slickensides below 12 inches; few fine soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—20 to 43 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few streaks of pale brown (10YR 6/3) clayey material in the upper part, percentage increases with depth; weak fine and medium blocky structure; extremely hard, very firm, sticky and plastic; few fine to medium vertical seams of dark gray (10YR 4/1) material in old closed cracks; few slickensides; few soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

C—43 to 65 inches; pink (7.5YR 7/4) clay, light brown (7.5YR 6/4) moist; few fine and medium faint reddish yellow and reddish brown mottles in lower part; massive; extremely hard, very firm, sticky and plas-

tic; few fine soft masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the A and AC horizons ranges from 24 to 50 inches. When these soils are dry, cracks from 0.3 to 1.0 inch wide extend from the surface or bottom of the Ap into the C horizon. Clay films can occur in the AC and C horizons.

The A horizon is very dark gray or dark gray. It is clay, clay loam, or sandy clay loam.

The AC horizon is gray, grayish brown, brown, or pale brown clay or clay loam in the upper part and light brownish gray, brown, pale brown, reddish brown, or light reddish brown clay in the lower part.

The C horizon is very pale brown, pale brown, light brown, pinkish gray, reddish yellow, reddish brown, light reddish brown, or pink. In places, the horizon has combinations of these colors and may be mottled in shades of gray. It is 3 to 25 percent soft masses and concretions of calcium carbonate in some part of some pedons.

Delfina series

The Delfina series consists of deep, loamy soils that formed in calcareous, loamy sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Delfina fine sandy loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and U.S. Highway 44 in Alice, about 8.8 miles south on U.S. Highway 281, 4.3 miles east on Farm Road 2508, and 250 feet south of right-of-way in pasture:

A1—0 to 12 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; hard, very friable; common fine and medium roots; common fine pores; slightly acid; clear smooth boundary.

B21t—12 to 16 inches;.brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles; few fine faint grayish brown and reddish yellow mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; few fine roots between peds; common fine pores; thick clay films on faces of peds; neutral; clear smooth boundary.

B22t—16 to 28 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; few fine distinct yellowish red mottles; few fine and medium faint grayish brown (10YR 5/2) and gray (10YR 6/1) mottles; weak coarse prismatic structure parting to moderate medium and coarse blocky; extremely hard, very firm; few fine roots between peds; thick continuous very dark grayish brown clay films on faces of peds; few fine black concretions; mildly alkaline; gradual wavy boundary.

B23t—28 to 36 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; moderately alkaline; gradual wavy boundary.

B24tca—36 to 40 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; 4 to 6 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B25t—40 to 53 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; 1 to 2 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B26tca—53 to 65 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; 7 to 10 percent, by volume, soft masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B27t—65 to 80 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, firm; patchy clay films on faces of peds; 2 to 3 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

The solum is 60 to more than 80 inches thick. Secondary carbonates are at a depth of 36 to 48 inches.

The A horizon is dark grayish brown, grayish brown, or brown. It is slightly acid or neutral.

The B21t and B22t horizons are brown in the upper part and brown, pale brown, light brown, or light yellowish brown in the lower part. There are common to many, fine and medium, distinct mottles of brownish yellow, yellowish brown, yellowish red, or red. These horizons range from neutral through moderately alkaline.

The B23t horizon is light yellowish brown, pale brown, light brown, or strong brown.

The underlying horizons are fine sandy loam or sandy clay loam. They are light yellowish brown, very pale brown, light brown, pink, or reddish yellow. Soft masses and concretions of calcium carbonate range from 2 to 20 percent.

Delmita series

The Delmita series consists of moderately deep, loamy soils that formed in loamy sediments over thick beds of caliche on uplands. Slopes range from 1 to 3 percent.

Typical pedon of Delmita fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 716 and U.S. Highway 281 in Premont, about 4.6 miles west on Farm Road 716, 6.7 miles north, 1.5 miles west on paved road, 0.2 mile north on ranch road, and 40 feet east in rangeland:

A1—0 to 10 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, very friable; common fine and medium roots; common fine pores; few worm casts; neutral; clear smooth boundary.

B2t—10 to 30 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable; few fine roots; few fine pores; few worm casts; thin patchy clay films on faces of peds; neutral; abrupt wavy boundary.

Ccam—30 to 32 inches; white strongly cemented and laminar caliche.

The solum is 25 to 40 inches thick. The soil is neutral or mildly alkaline.

The A horizon is brown or reddish brown.

The B2t horizon is reddish brown, yellowish red, or red. It is sandy loam or sandy clay loam.

The Ccam horizon is white, pinkish white, or pink. It is indurated to strongly cemented in the upper part becoming less cemented with depth.

Edroy series

The Edroy series consists of deep, clayey soils that formed in clayey sediments over sandy or loamy material in depressions or ponded areas on uplands. Slopes range from 0 to 1 percent.

Typical pedon of Edroy clay; from the intersection of Seven Bridges Road and North Texas Boulevard in Alice, about 2.3 miles northeast on Seven Bridges Road, then 825 feet east and 150 feet south in cultivated field:

A11—0 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; very hard, friable, sticky and plastic; many roots in and between peds; few fine pores; slightly acid; gradual smooth boundary.

A12—8 to 18 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, friable, sticky and plastic; many roots; uncoated sand grains in partially closed cracks that extend to a lower boundary; few short slickensides; few pressure faces on peds; neutral; gradual wavy boundary.

B21g—18 to 28 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; moderate medium prismatic structure parting to weak medium blocky; very hard, very firm, very sticky and very plastic; few fine roots; few fine and medium pores; few dark gray (10YR 4/1) streaks along old closed cracks; noncalcareous in matrix; moderately alkaline; gradual wavy boundary.

B22g—28 to 42 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; moderate medium prismatic structure parting to weak medium blocky; extremely hard, firm, sticky and plastic; few fine roots, mainly between peds; many fine and medium pores; slightly darker streaks on prism faces; few concretions and soft masses of calcium carbonate; noncalcareous in matrix; moderately alkaline; gradual wavy boundary.

B3gca—42 to 53 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; moderate medium prismatic structure parting to weak medium and fine blocky; extremely hard, firm, slightly sticky and plastic; few medium pores, many fine pores; about 3 percent, by volume, irregularly shaped concretions of calcium carbonate; few fine black concretions; noncalcareous in matrix; moderately alkaline; clear wavy boundary.

IICg—53 to 72 inches; white (2.5Y 8/2) loamy fine sand, light gray (2.5Y 7/2) moist; massive; extremely hard, very friable; common very fine and few medium black concretions and dark stains; noncalcareous; moderately alkaline.

The solum is 40 to 70 inches thick. When the soil is dry, cracks 0.5 to 1.0 inch wide extend from the surface to a depth of at least 28 inches.

The A horizon is very dark gray, dark gray, or gray. It is slightly acid or neutral.

The B2g horizon is gray in the upper part and gray, light gray, grayish brown, or light brownish gray in the lower part. It is clay, sandy clay, or clay loam. It is mildly alkaline or moderately alkaline.

The B3g horizon is gray, light gray, or light brownish gray. It is loam, clay loam, or sandy clay loam. It is 2 to 5 percent concretions of calcium carbonate.

The IICg horizon is fine sandy loam or loamy fine sand. It is moderately alkaline or strongly alkaline. Some pedons have a Cg horizon of clay loam or sandy clay loam.

Goliad series

The Goliad series consists of moderately deep, loamy soils that formed in clayey sediments over thick beds of caliche on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Goliad sandy clay loam, 0 to 1 percent slopes; from the intersection of Texas Highway 359 and U.S. Highway 281 in Alice, about 3.0 miles west on Texas Highway 359, 2.7 miles northwest on County

Road 236, 2.7 miles west on County Road 237, and 60 feet southwest in pasture:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky; common fine and medium roots; common fine pores; few worm casts; mildly alkaline; clear smooth boundary.

B21t—11 to 15 inches; brown (7.5YR 5/2) sandy clay, dark brown (7.5YR 4/2) moist; weak medium prismatic structure parting to moderate medium blocky; hard, friable, slightly sticky; common fine roots; few fine pores; common thin clay films on surface of peds; moderately alkaline; clear smooth boundary.

B22t—15 to 28 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to strong medium and coarse blocky; very hard, firm, sticky; few fine roots, mostly between peds; few fine pores; many clay films on surface of peds that are slightly darker colored than the matrix; moderately alkaline; abrupt wavy boundary.

Ccam—28 to 32 inches; white (10YR 8/2) and pinkish white (5YR 8/2) strongly cemented caliche that is fractured in the upper 1 to 2 inches at intervals of 3 to 10 inches horizontally; fracture interstices are filled with reddish brown (5YR 5/4) clay; cemented caliche fragments make up 95 percent of the volume in the upper 2 inches.

The solum is 20 to 40 inches thick.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. It is fine sandy loam or sandy clay loam. It ranges from neutral through moderately alkaline.

The B2t horizon is dark brown, brown, dark reddish brown, dark reddish gray, or reddish brown sandy clay loam, sandy clay, or clay loam in the upper part and reddish brown, yellowish red, reddish yellow, or red sandy clay, clay, or clay loam in the lower part. It ranges from neutral through moderately alkaline. In some pedons this horizon has few to common soft masses and concretions of calcium carbonate in the lower 1 to 4 inches.

The Ccam horizon is uniformly plugged with calcium carbonate and varies from weakly cemented to indurated. Porosity increases and cementation decreases gradually with depth.

Lacoste series

The Lacoste series consists of shallow, loamy soils that formed in loamy sediments over thick beds of caliche on uplands. Slopes range from 1 to 5 percent.

Typical pedon of Lacoste fine sandy loam, in an area of Lacoste-Olmos association, gently undulating; from the intersection of County Line Road and Texas Highway 359 in San Diego, about 9.0 miles north on County Line Road, 0.4 mile east on caliche road to cattleguard, 0.95 mile north on ranch road, and 50 feet west in pasture:

A11—0 to 2 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate medium platy structure; hard, very friable; common fine roots; few fine pores; mildly alkaline; abrupt smooth boundary.

A12—2 to 7 inches; brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; few fine pores; few fine concretions of calcium carbonate; moderately alkaline; clear smooth boundary.

B2t—7 to 12 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; few fine pores; thin patchy clay films on faces of peds; few fine concretions of calcium carbonate; moderately alkaline; abrupt wavy boundary.

Ccam—12 to 15 inches; white strongly cemented caliche that is fractured in upper part.

The solum is 10 to 18 inches thick, and within a horizontal distance of only a few feet it can go from 10 to 18 inches in thickness.

The A horizon is brown, strong brown, or reddish brown. It ranges from neutral through moderately alkaline.

The B2t horizon is reddish brown, yellowish red, or red. It ranges from neutral through moderately alkaline. It is fine sandy loam or sandy clay loam. Coarse fragments of calcium carbonate range from 0 to 15 percent, by volume.

The Ccam horizon is massive or fractured.

Lattas series

The Lattas series consists of deep, clayey soils that formed in thick, calcareous, clayey marine sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Lattas clay, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 359 in Alice, about 3.4 miles south on U.S. Highway 281, 5.6 miles east on Farm Road 1930, 0.25 mile east on caliche field road, and 40 feet south in cultivated field in microdepression:

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; very hard, firm, sticky and plastic; few fine

roots; few uncoated sand grains; calcareous; moderately alkaline; clear smooth boundary.

A11—5 to 21 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak fine blocky structure; very hard, very firm, sticky and plastic; few fine roots; few fine pores; common shiny pressure faces on peds; calcareous; moderately alkaline; gradual wavy boundary.

A12—21 to 29 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few streaks of gray (10YR 5/1) clayey material; weak fine and medium blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few very fine pores; many shiny pressure faces on peds; few intersecting slickensides; few threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—29 to 53 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common streaks of light brownish gray (10YR 6/2) clayey material in upper part, percentage increasing with depth; weak fine and medium blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few very fine pores; few vertical seams of dark gray (10YR 4/1) material in old closed cracks; few intersecting slickensides; few fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—53 to 70 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; extremely hard, very firm, sticky and plastic; few very fine pores; few vertical seams of dark gray (10YR 4/1) material in old closed cracks; few fine soft masses of calcium carbonate; few soft masses of calcareous gypsum; calcareous; moderately alkaline.

The A and AC horizons are 30 to 55 inches thick. Thickness of the A horizon varies from 6 inches in the center of microknolls to 34 inches in the center of microdepressions within a horizontal distance of 12 to 24 feet. When these soils are dry, cracks from 0.3 to 1.5 inches wide extend from the surface or from the base of the Ap horizon into the C horizon.

The A horizon is dark gray or very dark gray. It is clay, clay loam, or sandy clay loam in the upper part and clay, silty clay, or clay loam in the lower part.

The AC horizon in many places is divided into two parts. This division is most evident in microknolls. The horizon is gray in the upper part and gray, grayish brown, or light brownish gray in the lower part.

The C horizon is gray, light brownish gray, light gray, pinkish gray, white, or very pale brown.

Leming series

The Leming series consists of deep, sandy, valley soils that formed in ancient sandy alluvium. Slopes range from 0 to 5 percent.

Typical pedon of Leming loamy fine sand, 0 to 5 percent slopes; from the intersection of U.S. Highway 281 and Farm Road 716 in Premont, about 2 miles south on U.S. Highway 281, 2.4 miles east on paved road, and 425 feet south in pasture:

A11—0 to 13 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; single grained; loose, very friable; common fine and medium roots; neutral; gradual smooth boundary.

A12—13 to 24 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; single grained; loose, very friable; few fine roots; slightly acid; abrupt smooth boundary.

B21t—24 to 35 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common medium and coarse distinct yellowish red (5YR 5/8) and common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium and coarse blocky structure; very hard, firm; few fine roots; few fine pores; thick continuous clay films on faces of peds; neutral; gradual smooth boundary.

B22t—35 to 47 inches; light brownish gray (10YR 6/2) and very pale brown (10YR 7/3) sandy clay loam; few fine faint strong brown mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots; few fine pores; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

B23t—47 to 55 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; few fine faint light brown mottles; weak medium subangular blocky structure; very hard, firm; thin patchy clay films on faces of peds; mildly alkaline; clear wavy boundary.

Cca—55 to 65 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; 5 to 10 percent soft masses and concretions of calcium carbonate; moderately alkaline.

The solum is 50 to 70 inches thick.

The A horizon is grayish brown, light brownish gray, brown, or pale brown. It is slightly acid or neutral.

In the upper part, the B2t horizon is grayish brown, light brownish gray, or brown and has distinct mottles of red, reddish yellow, yellowish red, or strong brown. In the lower part, it is light gray or very pale brown, is mildly alkaline or moderately alkaline, and may have a few concretions of calcium carbonate in some pedons.

Miguel series

The Miguel series consists of deep, loamy soils that formed in thick beds of clayey and loamy sediments on uplands. Slopes range from 1 to 3 percent.

Typical pedon of Miguel fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 44 in Alice, about 3 miles south on U.S. Highway 281, 1.7 miles west on Farm Road 625, 0.5 mile north and 0.5 mile west on ranch road, and 50 feet south of road in rangeland:

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to weak fine granular; very hard, friable; many fine roots; few insect tunnels; slightly acid; abrupt smooth boundary.

B21t—10 to 13 inches; brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) moist; common medium distinct reddish brown (5YR 4/4) mottles; strong medium prismatic structure parting to moderate medium blocky; extremely hard, firm, sticky and plastic; many fine roots; few fine pores; organic stains and dark coatings on faces of prisms; clay films on faces of peds; neutral; clear smooth boundary.

B22t—13 to 29 inches; brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 4/4) moist; many fine faint yellowish red mottles; moderate medium prismatic structure parting to moderate medium and fine blocky; very hard, very firm, sticky and plastic; few roots between peds; clay films on faces of peds; neutral; gradual smooth boundary.

B23t—29 to 33 inches; reddish yellow (7.5YR 6/6) sandy clay, strong brown (7.5YR 5/6) moist; weak coarse prismatic structure parting to fine subangular blocky; very hard, very firm, sticky and plastic; few clay films; few fine weakly cemented concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

B3ca—33 to 45 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak coarse prismatic structure; very hard, friable, sticky; about 3 percent, by volume, weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—45 to 60 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. Secondary carbonates are at a depth of 28 to 40 inches.

The A horizon is dark grayish brown, brown, dark yellowish brown, reddish brown, or grayish brown. It is slightly acid or neutral.

The B2t horizon is dark brown, brown, yellowish brown, brownish yellow, light brown, or yellowish red. Mottles are common or many, fine or medium, and in shades of brown, red, or yellow. This horizon is neutral or mildly alkaline. It is sandy clay or clay.

The B3 horizon is light brown, reddish yellow, brown, light yellowish brown, or yellowish red. It is sandy clay loam or sandy clay. It is mildly alkaline or moderately alkaline. In the lower part of some pedons this horizon is 3 to 10 percent, by volume, weakly cemented concretions and soft masses of calcium carbonate.

The C horizon is light brownish gray, light gray, light brown, yellowish red, reddish yellow, pink, or brownish yellow. It is sandy clay loam or sandy clay.

Odem series

The Odem series consists of deep, loamy soils that formed in recent loamy alluvial sediments on bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Odem fine sandy loam; from the intersection of U.S. Highway 281 and U.S. Highway 44 in Alice, about 4.3 miles north on U.S. Highway 281, 0.5 mile west on county road, 0.65 mile north along fence, and 525 feet east in cultivated field:

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular and subangular blocky structure; slightly hard, friable; few fine roots; many fine pores; moderately alkaline; abrupt smooth boundary.

A1—6 to 46 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots; many fine and medium pores; few fine soft masses of calcium carbonate; moderately alkaline; diffuse boundary.

C—46 to 72 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; few fine soft masses and concretions of calcium carbonate; calcareous in the lower part; moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown. It ranges from neutral through moderately alkaline.

The C horizon is grayish brown or light brownish gray. It is mildly alkaline or moderately alkaline.

Olmos series

The Olmos series consists of shallow, loamy soils that formed in limestone outwash sediments on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Olmos gravelly loam in an area of Olmos association, undulating; from the intersection of U.S. Highway 281 and Texas Highway 44 in Alice, about 9.5 miles north on U.S. Highway 281, 2.1 miles west-northwest on County Road 235, and 50 feet north in pasture:

A11—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; few fine pores; few worm casts; 3 to 5 percent concretions and fragments of calcium carbonate mostly less than 5 millimeters wide; about 20 percent caliche fragments; calcareous; moderately alkaline; clear wavy boundary.

A12—3 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; common fine and medium roots; few fine pores; few worm casts; about 5 to 10 percent concretions and fragments of calcium carbonate mostly less than 1 centimeter wide; about 30 percent caliche fragments; calcareous; moderately alkaline; abrupt wavy boundary.

Clcam—9 to 13 inches; white (10YR 8/1) and pink (7.5YR 7/4) strongly cemented, laminar caliche; few solution channels in the upper part that are filled with gray and dark gray loamy material; gradual wavy boundary.

C2cam—13 to 35 inches; white (10YR 8/1) weakly cemented nodular caliche; interstices between nodules filled with light brownish gray loamy material.

The A horizon is frequently divided into two parts. In the upper part it is 1 to 5 inches thick and is gravelly clay loam or gravelly loam. In the lower part it is 4 to 10 inches thick and is gravelly loam and 20 to 35 percent coarse caliche fragments. This horizon is dark grayish brown, grayish brown, or dark brown.

The C horizon is strongly cemented or indurated and laminar in the upper 2 to 7 inches. In places this layer is fractured and filled with A horizon material. In the lower part it is moderately cemented to weakly cemented, fractured caliche or about 50 to 85 percent nodules and soft masses of calcium carbonate. Interstices between nodules are filled with light brownish gray or gray loamy material.

Opelika series

The Opelika series consists of deep, loamy soils that formed in calcareous loamy sediments on uplands. Slopes range from 0 to 1 percent.

Typical pedon of Opelika fine sandy loam; from the intersection of U.S. Highway 281 and Texas Highway 141 south of Alice, about 1.6 miles south on U.S. Highway 281, 1.25 miles west-northwest on ranch road, 0.3 mile south along pipeline, and 100 feet east in pasture:

A1—0 to 4 inches; gray (10YR 5/1) fine sandy loam, very dark gray (10YR 3/1) moist; few fine faint brown stains along root channels; massive; very hard, friable; many fine roots; few fine pores; few worm casts; neutral; abrupt smooth boundary.

B21t—4 to 10 inches; dark gray (10YR 4/1) sandy clay, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few fine roots, mostly between prism faces; few fine pores; thick continuous clay films on faces of prisms; vertical faces of prisms partially covered with uncoated sand grains; mildly alkaline; clear wavy boundary.

B22t—10 to 19 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots; few fine pores; thick patchy clay films on faces of prisms; vertical prism faces partially covered with uncoated sand grains; few fine soft masses of calcium carbonate in the lower part; moderately alkaline; gradual wavy boundary.

B23tca—19 to 30 inches; gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; weak fine and medium subangular blocky structure; hard, friable; common fine pores; common streaks of light brownish gray (10YR 6/2) material; common soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—30 to 60 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; few fine faint yellowish mottles; massive; hard, friable; common fine pores; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 24 to 44 inches thick. Secondary carbonates are at a depth of 16 to 30 inches.

The A horizon is dark gray, gray, grayish brown, or dark grayish brown. It is fine sandy loam, sandy clay loam, or loam. It is neutral or mildly alkaline.

The B2t horizon is dark gray, gray, grayish brown, dark grayish brown, or light brownish gray. It is sandy clay, sandy clay loam, or clay loam. This horizon ranges from neutral through moderately alkaline. Few to common soft masses and fine concretions of calcium carbonate occur in the lower part.

The C horizon is gray, light brownish gray, white, or pale brown. It is sandy clay loam or clay loam. It has few to common soft masses and concretions of calcium carbonate.

Papagua series

The Papagua series consists of deep, sandy and loamy soils that formed in sandy and loamy deposits on uplands. Slopes range from 0 to 1 percent.

Typical pedon of Papagua soils, depressional; from the intersection of U.S. Highway 281 and Farm Road 716 in Premont, about 2.6 miles north on U.S. Highway 281, 0.2 mile east to Mobil Plant entrance, north then east 1.35

miles, 0.4 mile northeast on ranch road, and 30 feet northwest in pasture:

A1—0 to 16 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; hard, very friable; few fine and medium roots; few fine pores; neutral; abrupt smooth boundary.

B21t—16 to 30 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common medium distinct brownish yellow (10YR 6/6) and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium and coarse blocky; extremely hard, firm, slightly sticky; few fine roots; thin continuous clay films on faces of peds; few black concretions less than 5 millimeters wide; neutral; gradual wavy boundary.

B22t—30 to 46 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; few fine faint strong brown and gray mottles; moderate medium subangular blocky structure; very hard, firm, slightly sticky; few fine roots; thin patchy clay films on faces of peds; few black concretions less than 5 millimeters wide; neutral; gradual wavy boundary.

B23tca—46 to 57 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky; thin patchy clay films on faces of peds; few black concretions less than 3 millimeters wide; few fine soft masses of calcium carbonate; moderately alkaline; gradual wavy boundary.

Cca—57 to 65 inches; very pale brown (10YR 7/3) sandy clay loam, light gray (10YR 7/2) moist; massive; hard, firm; common soft masses and concretions of calcium carbonate; moderately alkaline.

The solum is 40 to 60 inches thick. Secondary carbonates are at a depth of 36 to 50 inches.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or brown. It is fine sandy loam or loamy fine sand. It is slightly acid or neutral. In some pedons the A2 horizon is weakly expressed, lighter in color, and is less than 2 inches thick.

The B2t horizon is dark grayish brown, grayish brown, light brownish gray, light gray, brown, pale brown, or very pale brown that has chroma of 3 in the lower part. In the upper part it has faint or distinct brown, yellow, or red mottles. It is sandy clay or sandy clay loam. It is slightly acid or neutral in the upper part and mildly alkaline or moderately alkaline in the lower part.

The C horizon is pale brown, very pale brown, light gray, or white. It has few to common soft masses and concretions of calcium carbonate.

Papalote series

The Papalote series consists of deep, loamy soils that formed in clayey and loamy sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Papalote fine sandy loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and U.S. Highway 44 in Alice, about 19.4 miles south on U.S. Highway 281, 3 miles east on paved road, 0.75 mile north on ranch road, and 30 feet east in pasture:

A1—0 to 16 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; many fine pores; neutral; abrupt smooth boundary.

B21t—16 to 20 inches; brown (7.5YR 4/2) sandy clay, dark brown (7.5YR 3/2) moist; common fine prominent red and few fine faint gray mottles; weak coarse prismatic structure parting to moderate medium and coarse blocky; very hard, very firm; few fine roots; few fine pores; thick continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—20 to 31 inches; brown (7.5YR 5/2) sandy clay, brown (7.5YR 4/2) moist; common fine and medium distinct yellowish red (5YR 5/6), few fine prominent red, and common fine faint grayish brown mottles; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, very firm; few fine roots; few fine pores; thick continuous clay films on faces of peds; moderately alkaline; clear wavy boundary.

B23t—31 to 38 inches; light brown (7.5YR 6/4) sandy clay, brown (7.5YR 5/4) moist; weak coarse subangular blocky structure; very hard, very firm; thin patchy clay films on faces of peds; moderately alkaline; gradual wavy boundary.

B3ca—38 to 49 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; few fine faint strong brown mottles; weak fine and medium subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—49 to 65 inches; pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, firm; common soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. Secondary carbonates are at a depth of 28 to 50 inches.

The A horizon is grayish brown, light brownish gray, or brown. It is fine sandy loam or loamy fine sand. It ranges from slightly acid through mildly alkaline. Some pedons have an A2 horizon that is thin and is gray or light gray.

The B2t horizon, in the upper part, is dark grayish brown, dark brown, brown, or grayish brown sandy clay or clay. In the lower part it is gray, grayish brown, light brownish gray, or brown and has red, yellow, and gray mottles. This horizon ranges from neutral through moderately alkaline.

The B3ca horizon is pale brown, light brownish gray, light brown, brown, or light gray.

The Cca horizon is light gray, very pale brown, light brown, pink, or reddish yellow. It is sandy clay or sandy clay loam. It is 2 to 10 percent, by volume, soft masses and fine concretions of calcium carbonate.

Parrita series

The Parrita series consists of shallow, loamy soils that formed in beds of clayey sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Parrita sandy clay loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 44 in Alice, about 9.5 miles north on U.S. Highway 281, 0.5 mile west on County Road 235, and 50 feet north in pasture:

A1—0 to 5 inches; dark brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky; common fine roots; few fine pores; few insect and worm burrows; mildly alkaline; clear smooth boundary.

B21t—5 to 9 inches; dark reddish brown (5YR 3/2) sandy clay loam, very dark gray (5YR 3/1) moist; moderate medium prismatic structure parting to weak medium subangular blocky; very hard, firm, slightly sticky; few fine roots; few fine pores; thin patchy clay films on surfaces of peds; few worm casts; moderately alkaline; clear smooth boundary.

B22t—9 to 17 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky; few fine roots, mostly between peds; few fine pores; thin patchy clay films on surfaces of peds, which are slightly darker than matrix; moderately alkaline; abrupt wavy boundary.

Ccam—17 to 24 inches; white (10YR 8/2) and pinkish white (5YR 8/2) strongly cemented and laminar caliche that has a few fine fractures at intervals of 1 to 4 feet horizontally.

The solum is 12 to 20 inches thick.

The A horizon is very dark grayish brown, dark grayish brown, brown, dark brown, or dark reddish brown. It ranges from neutral through moderately alkaline.

The B2t horizon is dark brown, dark reddish brown, reddish brown, brown, yellowish red, or red. It ranges from neutral through moderately alkaline. It is sandy clay loam, clay, or sandy clay in the upper part and sandy clay or clay in the lower part.

The Ccam horizon is cemented or indurated caliche that breaks to plate-like fragments. In some pedons it becomes less cemented with depth.

Pernitas series

The Pernitas series consists of deep, loamy, upland soils that formed in calcareous loamy sediments on uplands. Slopes range from 0 to 5 percent.

Typical pedon of Pernitas sandy clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 359 in Alice, about 3 miles west on Texas Highway 359, 10 miles north and 2.7 miles northwest on County Road 236, 4.1 miles west on County Road 237, and 0.3 mile southwest in pasture:

A1—0 to 11 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky; common fine and medium roots; common fine pores; few worm casts; few insect tunnels; few snail shells; few fine threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21t—11 to 17 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky; few fine and medium roots; common fine pores; thin patchy clay films on surfaces of peds; few fragments of snail shell; few threads and very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22t—17 to 30 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky; few fine roots, mostly between peds; few fine pores; thin patchy clay films on surfaces of peds; few fine threads and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1ca—30 to 36 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky; about 20 to 25 percent by volume soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—36 to 72 inches; pinkish gray (7.5YR 7/2) clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable, slightly sticky; about 15 to 20 percent calcium mostly in the form of soft, irregularly shaped masses; calcareous; moderately alkaline.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, or brown. It is sandy clay loam or fine sandy loam.

The B2t horizon is dark grayish brown, grayish brown, or brown sandy clay loam or clay loam in the upper part and pale brown, light brown, brown, yellowish brown, or light yellowish brown clay loam or sandy clay loam in the lower part.

The Cca horizon is light brownish gray, very pale brown, pale brown, pinkish gray, light brown, or pink. It is clay loam or sandy clay loam. It is 10 to 40 percent, by volume, soft masses and concretions of calcium carbonate up to 3.5 centimeters wide.

Pettus series

The Pettus series consists of shallow, loamy soils that formed in calcareous loamy sediments on uplands. Slopes range from 0 to 5 percent.

Typical pedon of Pettus sandy clay loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 359 in Alice, about 3.0 miles west on Texas Highway 359, 10 miles north and 2 miles northwest on County Road 236, and 70 feet southwest in pasture:

A1—0 to 10 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; common fine and medium roots; common fine pores; common worm casts; few snail shells; common fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2—10 to 17 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; common fine roots; common fine pores; common worm casts; few snail shells; common fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Clca—17 to 21 inches; white (10YR 8/2) weakly cemented platy and fractured caliche, light gray (10YR 7/2) moist; fracture interstices, root channels, and solution channels comprise about 10 percent of the volume and are filled with light brownish gray (10YR 6/2) sandy clay loam; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—21 to 65 inches; white (10YR 8/1) gravelly sandy clay loam, light gray (10YR 7/2) moist; massive; about 60 percent soft masses and nodular concretions of calcium carbonate up to 2 centimeters wide.

The A horizon is dark grayish brown, grayish brown, or brown.

The B2 horizon is grayish brown, light brownish gray, brown, or pale brown. It is loam or sandy clay loam. Calcium carbonate concretions make up 5 to 20 percent of the volume and are mostly less than 1 centimeter wide.

The Cca horizon is light gray, pale brown, or white. The Clca horizon is weakly or moderately cemented platy and fractured caliche. The C2ca horizon is weakly cemented fractured caliche or is about 10 to 50 percent weakly cemented nodular concretions and soft masses of calcium carbonate. The fine earth fraction is brownish sandy clay loam or loam.

Pharr series

The Pharr series consists of deep, loamy soils that formed in calcareous loamy sediment of eolian or alluvial origin on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Pharr fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 281 and Farm Road 2295 about 15.0 miles south of Alice, 2.8 miles west on Farm Road 2295, 100 feet south along fenceline, and 30 feet west in pasture:

A11—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, very friable; common fine and medium roots; few fine pores; common termite and earthworm tunnels partially filled with calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12t—9 to 15 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few fine pores; common termite and earthworm tunnels partially filled with calcium carbonate; few snail shells; calcareous; moderately alkaline; clear wavy boundary.

B2t—15 to 33 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, friable; few fine roots; few fine pores; thin patchy clay films on faces of peds; few threads and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B3ca—33 to 45 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; 5 percent soft masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—45 to 65 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive; hard, firm; 10 percent fine and medium soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick.

The A horizon is dark grayish brown, grayish brown, or dark brown. It is fine sandy loam or loam.

The B horizon is grayish brown, brown, or pale brown. It is sandy clay loam or clay loam that has films, threads, masses, and fine concretions of calcium carbonate. The content of calcium carbonate increases with depth.

The Cca horizon is very pale brown, pale brown, or light gray. It is sandy clay loam or clay loam. It is 5 to 25 percent, by volume, soft masses and concretions of calcium carbonate.

Racombes series

The Racombes series consists of deep, loamy soils that formed in alkaline, loamy sediments on uplands. Slopes range from 0 to 1 percent.

Typical pedon of Racombes sandy clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 281 and Texas Highway 141, 3.8 miles south on U.S. Highway 281, and 200 feet east in pasture:

A1—0 to 11 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; common fine pores; few fragments of snail shell; neutral; clear smooth boundary.

B21t—11 to 23 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium and coarse blocky; hard, firm; few fine roots; few fine pores; thick continuous clay films on faces of peds; neutral; gradual wavy boundary.

B22t—23 to 41 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; weak medium prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots between peds; thick continuous clay films on faces of peds; neutral; clear wavy boundary.

Cca—41 to 76 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; hard, firm; few fine pores; few fine concretions and common soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 53 inches thick. The mollic epipedon is 21 to 35 inches thick. The soil ranges from neutral through moderately alkaline. Secondary carbonates are at a depth of 36 to 48 inches.

The A horizon is very dark gray, dark gray, very dark grayish brown, or dark grayish brown.

The B2t horizon is dark grayish brown, brown, grayish brown, or pale brown. It is sandy clay loam or clay loam.

The Cca horizon is pale brown, light brown, very pale brown, or pink. It is 3 to 15 percent, by volume, fine concretions and soft masses of calcium carbonate.

Runge series

The Runge series consists of deep, loamy soils that formed in loamy calcareous material that derived from sandstone or alluvium on uplands. Slopes range from 0 to 5 percent.

Typical pedon of Runge fine sandy loam, 1 to 3 percent slopes; about 1 mile south of Ben Bolt on U.S. Highway 281, 1.7 miles west on graded road, 1 mile south on an unimproved ranch road, and 100 feet west in pasture:

A1—0 to 14 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; few insect tunnels; neutral; gradual smooth boundary.

B21t—14 to 18 inches; reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/3) moist; moderate medium prismatic structure parting to weak subangular blocky; slightly hard, friable; few fine roots; few fine pores; few worm casts; common clay films and dark coatings on prisms; neutral; gradual smooth boundary.

B22t—18 to 34 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; slightly sticky; common fine and medium pores; few patchy clay films and dark coatings on prisms and exteriors of peds; few fine soft masses and concretions of calcium carbonate below 30 inches; mildly alkaline; gradual smooth boundary.

B3—34 to 55 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; hard, friable, slightly sticky; many fine and medium pores; few fine soft masses and concretions of calcium carbonate; matrix noncalcareous; moderately alkaline; gradual smooth boundary.

Cca—55 to 72 inches; reddish yellow (7.5YR 8/6) sandy clay loam, reddish yellow (7.5YR 7/6) moist; massive; slightly hard, friable; about 5 percent, by volume, concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 33 to 60 inches thick.

The A horizon is brown, dark brown, or dark grayish brown. It is fine sandy loam or loam. It is neutral or mildly alkaline.

The B2t horizon is reddish brown, yellowish red, or reddish yellow sandy clay loam or clay loam. It ranges from neutral through moderately alkaline. In some

pedons there are a few threads and soft masses of calcium carbonate.

The B3 horizon is brown, light brown, reddish yellow, or yellowish red. It is noncalcareous or calcareous and has a few soft masses and concretions of calcium carbonate.

The C horizon is very pale brown, light brown, brown, or reddish yellow. It is sandy clay loam or loam. Calcium carbonate content ranges from 5 to 15 percent.

Sarita series

The Sarita series consists of deep, sandy soils that formed in sandy and loamy eolian and water-laid deposits on uplands. Slopes range from 0 to 5 percent.

Typical pedon of Sarita loamy fine sand, 0 to 5 percent slopes; from the intersection of Farm Road 624 and U.S. Highway 281 north of Alice, about 3.25 miles northwest on Farm Road 624, 0.35 mile northeast, 0.55 mile southeast, and 0.50 mile northeast on caliche road, and 50 feet northwest in pasture:

A1—0 to 9 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose, very friable; few fine roots; neutral; clear smooth boundary.

A2—9 to 63 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grained; loose, very friable; few fine roots; neutral; abrupt smooth boundary.

B21t—63 to 70 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; few fine and medium faint strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; weak fine and medium subangular blocky structure; hard, friable; thin patchy clay films on faces of peds; slightly acid; clear smooth boundary.

B22t—70 to 80 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; common fine and medium faint light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very hard, friable; few thin patchy clay films on faces of peds; few fine black concretions; slightly acid.

The solum is 60 to 100 inches thick.

The A horizon is grayish brown or light brownish gray in the upper part and pale brown, light brown, or very pale brown in the lower part. It is loamy fine sand or fine sand. It is slightly acid or neutral.

The B2t horizon is light brownish gray, pale brown, or light yellowish brown, and it has red, yellow, and gray mottles. It is fine sandy loam or sandy clay loam. It is slightly acid through moderately alkaline.

Sinton series

The Sinton series consists of deep, loamy soils that formed in calcareous, loamy sediment of alluvial origin on bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Sinton sandy clay loam; from the intersection of Texas Highway 359 and Farm Road 624 in Orange Grove, about 3.4 miles northeast on Texas Highway 359, 2.7 miles northwest on Farm Road 534, and 150 feet southwest in rangeland along Pernitas Creek:

A11—0 to 10 inches; very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; hard, friable; common fine and medium roots; common fine pores; few worm casts; few fragments of snail shell; calcareous; moderately alkaline; clear smooth boundary.

A12—10 to 34 inches; dark gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; hard, friable; few fine and medium roots; common fine and medium pores; common worm casts; few fragments of snail shell; calcareous; moderately alkaline; gradual smooth boundary.

C1—34 to 50 inches; light brownish gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few thin strata of loamy fine sand; few fragments of snail shell; few threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2—50 to 65 inches; light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable; few threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon is very dark gray or dark gray.

The C horizon is pale brown, light brownish gray, or light gray. It is sandy clay loam or loam.

Formation of the soils

This section discusses the factors of soil formation and relates them to the soils in Jim Wells County.

Factors of soil formation

Soil is produced by the action of soil-forming processes on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time the forces of soil development have acted on the soil material.

Climate and living organisms are active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and living organisms are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always needed for horizon differentiation. Usually a long time is needed for distinct horizons to develop.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Parent material refers to the unconsolidated mass from which soil develops.

The soils of Jim Wells County formed in residuum of limestone and sandstone, in ancient and recent alluvium, and in ancient marine deposits. They began forming in the Miocene, Pliocene, and Pleistocene periods.

Shallow soils are on the steeper slopes where erosion has kept pace with soil development. The major shallow soils in the county are the Lacoste, Olmos, Parrita, and Pettus soils, all of which are underlain by caliche.

Moderately deep soils such as the Lattas and Danjer soils formed in calcareous, clayey, marine sediments. The Delmita and Goliad soils formed in loamy and clayey sediments over thick beds of caliche, the Opelika soils formed in loamy and clayey marine sediments, and the Pernitas soils formed in calcareous loamy sediments.

Parent material of the deep soils is mainly alkaline, unconsolidated, sandy, clayey, and loamy sediments. This ancient alluvium or marine material may have been reworked by wind or affected by a high water table many times since it was first deposited. The major soils are Clareville, Comitas, Czar, Delfina, Leming, Miguel, Papagua, Papalote, Pharr, Racombes, Runge, and Sarita soils.

Alluvial soils in the county are very young. They are the Aransas, Odem, and Sinton soils, which are on the flood plains of the major creeks and rivers.

Climate

Precipitation, temperature, and wind have had a major effect on the formation of the soils in Jim Wells County.

In past geological ages, the wet climate had an effect on how the parent material was deposited. Later, as the soils began to develop, the climate became subhumid. Because the rainfall was limited, minerals were not leached from the soils, and, except for the sandy soils, most of the soils are medium to high in fertility. Because the soils seldom get wet to a depth of more than 6 feet, many soils have an accumulation of calcium carbonate a few feet below the surface. Most of the young soils have lime throughout the horizons.

Summer temperatures are high, and winter temperatures are mild. The high temperatures and low rainfall have limited the accumulation of organic matter in the soils.

Plant and animal life

Plants, animals, insects, and bacteria are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in soil structure and porosity are among the changes caused by living organisms.

Vegetation, dominantly grasses, has affected soil formation in Jim Wells County more than other living organisms.

Relief

Relief influences soil formation through its effect on drainage and runoff. If other factors are equal, the degree of profile development depends mainly on the average amount of moisture in the soil. Because nearly level soils absorb more moisture, they generally have a better developed profile than steeper soils, which can erode almost as fast as they form.

Relief also affects the kind and amount of vegetation on a soil. Because slopes that face north and east receive less direct sunlight than those facing south and west, they lose less moisture through evaporation. As a result, the vegetation is denser on slopes facing north and east.

Soils that are nearly level or slightly concave receive more moisture than sloping soils and produce more vegetation; consequently, they generally have more organic matter, which imparts a darker color to the soil.

Time

Time is needed for the formation of soils that have distinct horizons. The differences in the length of time that parent materials have been in place are commonly reflected in the degree of profile development.

The soils in Jim Wells County range from young to old. The young soils have very little profile development, and the older soils have well expressed soil horizons. The bottom land soils are examples of young soils that do not have profile development.

Soils that have been in place for long periods and that occur on nearly level to gentle slopes generally show the greatest profile development, for example, Delfina and Runge soils.

Many shallow soils on steep slopes have been forming as long as the well-developed, nearly level soils. Because geologic erosion has removed the effects of soil formation, the shallow soils have not reached an equilibrium with their environment. Thus, on steep slopes, relief

has been the dominant soil-forming factor, and not time. Lacoste and Pettus soils are examples of such soils.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods

during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as pro-

tection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject

to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-76 at Alice, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	68.0	43.6	55.8	90	22	236	1.24	0.18	2.03	3	0.0
February---	72.1	46.6	59.4	91	25	288	1.58	0.26	2.59	3	0.2
March------	78.1	53.0	65.6	98	33	489	0.79	0.13	1.29	2	0.0
April------	84.7	62.2	73.5	101	42	705	1.56	0.19	2.58	3	0.0
May--------	88.6	67.7	78.1	101	52	871	3.05	1.03	4.66	5	0.0
June-------	93.5	72.3	82.9	101	62	987	3.46	0.87	5.51	4	0.0
July-------	96.3	73.6	85.0	103	68	1,085	1.62	0.25	2.64	3	0.0
August-----	97.4	73.4	85.4	105	66	1,097	2.26	0.32	3.72	4	0.0
September--	92.1	70.0	81.1	103	56	933	6.56	2.54	9.81	7	0.0
October----	85.4	61.1	73.3	97	42	722	3.29	0.64	5.36	4	0.0
November---	76.4	52.7	64.6	92	31	445	1.56	0.27	2.53	3	0.0
December---	69.4	45.7	57.6	88	27	270	1.19	0.27	1.90	3	0.0
Yearly:											
Average--	83.5	60.2	71.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	21	---	---	---	---	---	---
Total----	---	---	---	---	---	8,128	28.16	19.84	35.73	44	0.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-76 at Alice, Texas]

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	January 30	February 19	March 16
2 years in 10 later than--	January 17	February 9	March 6
5 years in 10 later than--	([1])	January 19	February 16
First freezing temperature in fall:			
1 year in 10 earlier than--	December 26	December 10	November 13
2 years in 10 earlier than--	January 7	December 19	November 22
5 years in 10 earlier than--	([1])	January 5	December 10

[1]Probability of occurrence is less than 5 years in 10.

TABLE 3.--LENGTH OF GROWING SEASON

[Data were recorded in the period 1951-76 at Alice, Texas. The symbol > means more than]

Probability	Daily minimum temperature during growing season		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	>365	308	262
8 years in 10	>365	318	274
5 years in 10	>365	>365	296
2 years in 10	>365	>365	319
1 year in 10	>365	>365	330

TABLE 4.--MAP UNITS AND THEIR POTENTIALS

Map unit	Percent of county	Cultivated farm crops	Rangeland	Urban uses	Recreation
1. Lattas-Opelika-Clareville-----	23	High: low rainfall.	High: low rainfall.	Low: shrink-swell, corrosivity, low strength, percs slowly.	Low: too clayey, percs slowly.
2. Lattas------------------------	3	High: low rainfall.	High: low rainfall.	Low: shrink-swell, corrosivity, low strength, percs slowly.	Low: too clayey, percs slowly.
3. Pernitas-Olmos-Pettus---------	20	Medium: erodes easily, low rainfall, cemented pan, small stones.	Medium: erodes easily, low rainfall, cemented pan.	Medium: shrink-swell, corrosivity, low strength, seepage, cemented pan.	Medium: too clayey, slope, small stones.
4. Goliad-Parrita-Lacoste--------	8	Medium: erodes easily, low rainfall, cemented pan.	Medium: erodes easily, low rainfall, cemented pan.	Medium: shrink-swell, corrosivity, low strength, cemented pan, percs slowly.	High: too clayey, cemented pan.
5. Runge-Delfina-Papalote--------	17	High: low rainfall.	High: low rainfall.	Medium: shrink-swell, corrosivity, low strength, percs slowly.	Medium: percs slowly, slope.
6. Opelika-Delfina-Czar----------	16	Medium: erodes easily, low rainfall.	High: low rainfall.	Medium: shrink-swell, corrosivity, low strength, percs slowly, wetness.	Medium: percs slowly, wetness.
7. Delfina-Papagua-Papalote------	9	Medium: erodes easily, low rainfall.	Medium: erodes easily, low rainfall.	Medium: shrink-swell, corrosivity, low strength, percs slowly.	Medium: percs slowly, wetness.
8. Papalote-Czar-----------------	3	Medium: erodes easily, low rainfall.	Medium: erodes easily, low rainfall.	Medium: shrink-swell, corrosivity, low strength, percs slowly.	High.
9. Aransas-Sinton----------------	1	Low: floods.	High: low rainfall.	Low: shrink-swell, corrosivity, low strength, floods.	Low: too clayey, wetness, floods.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aransas clay	1,712	0.3
2	Aransas clay, frequently flooded	2,943	0.5
3	Clareville loam, 0 to 1 percent slopes	25,545	4.7
4	Comitas loamy fine sand, 0 to 3 percent slopes	2,596	0.5
5	Czar fine sandy loam, 0 to 1 percent slopes	11,374	2.1
6	Czar fine sandy loam, 1 to 3 percent slopes	14,703	2.7
7	Danjer clay, 0 to 1 percent slopes	1,460	0.3
8	Danjer clay, 1 to 3 percent slopes	2,113	0.4
9	Delfina loamy fine sand, 0 to 2 percent slopes	19,064	3.5
10	Delfina fine sandy loam, 0 to 1 percent slopes	29,280	5.4
11	Delfina fine sandy loam, 1 to 3 percent slopes	16,949	3.1
12	Delmita fine sandy loam, 1 to 3 percent slopes	1,944	0.4
13	Edroy clay	7,644	1.4
14	Edroy clay, depressional	8,407	1.6
15	Goliad fine sandy loam, 0 to 1 percent slopes	1,417	0.3
16	Goliad fine sandy loam, 1 to 3 percent slopes	7,343	1.4
17	Goliad sandy clay loam, 0 to 1 percent slopes	5,713	1.1
18	Goliad sandy clay loam, 1 to 3 percent slopes	1,860	0.3
19	Lacoste-Olmos association, gently undulating	10,422	1.9
20	Lattas clay, 0 to 1 percent slopes	61,312	11.3
21	Lattas clay, 1 to 3 percent slopes	4,620	0.9
22	Leming loamy fine sand, 0 to 5 percent slopes	4,268	0.8
23	Miguel fine sandy loam, 1 to 3 percent slopes	6,973	1.3
24	Odem fine sandy loam	1,177	0.2
25	Oil-Waste land	100	(1)
26	Olmos association, undulating	17,054	3.1
27	Opelika fine sandy loam	45,090	8.3
28	Opelika fine sandy loam, depressional	31,005	5.7
29	Papagua soils, depressional	23,346	4.3
30	Papalote loamy fine sand, 0 to 3 percent slopes	10,701	2.0
31	Papalote fine sandy loam, 0 to 1 percent slopes	15,720	2.9
32	Parrita sandy clay loam, 0 to 3 percent slopes	15,085	2.8
33	Pernitas fine sandy loam, 1 to 5 percent slopes	7,369	1.4
34	Pernitas sandy clay loam, 0 to 1 percent slopes	11,693	2.2
35	Pernitas sandy clay loam, 1 to 5 percent slopes	23,181	4.3
36	Pernitas sandy clay loam, gullied	293	(1)
37	Pettus sandy clay loam, 0 to 3 percent slopes	3,231	0.6
38	Pettus sandy clay loam, 3 to 5 percent slopes	1,418	0.3
39	Pettus sandy clay loam, gullied	3,306	0.6
40	Pharr fine sandy loam, 0 to 1 percent slopes	3,098	0.6
41	Pharr fine sandy loam, 1 to 3 percent slopes	5,062	0.9
42	Pharr sandy clay loam, 0 to 1 percent slopes	4,897	0.9
43	Pharr sandy clay loam, 1 to 3 percent slopes	1,644	0.3
44	Pits	467	0.1
45	Racombes sandy clay loam, 0 to 1 percent slopes	25,597	4.7
46	Runge fine sandy loam, 0 to 1 percent slopes	5,169	1.0
47	Runge fine sandy loam, 1 to 3 percent slopes	30,305	5.6
48	Runge fine sandy loam, 3 to 5 percent slopes	342	(1)
49	Runge sandy clay loam, 0 to 1 percent slopes	305	(1)
50	Runge sandy clay loam, 1 to 3 percent slopes	1,241	0.2
51	Sarita loamy fine sand, 0 to 5 percent slopes	490	0.1
52	Sinton sandy clay loam	2,816	0.5
	Water	1,216	0.2
	Total	542,080	100.0

[1]Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Grain sorghum	Cotton lint	Flax	Pasture
	Bu	Lb	Bu	AUM[1]
Aransas:				
1	55	450	---	5.0
2	---	---	---	5.0
Clareville:				
3	55	450	16	---
Comitas:				
4	45	---	---	3.0
Czar:				
5	45	350	---	4.0
6	40	325	---	3.5
Danjer:				
7	55	375	15	4.0
8	45	325	10	3.5
Delfina:				
10	50	375	---	---
9, 11	35	250	---	---
Delmita:				
12	25	200	---	2.0
Edroy:				
13	35	300	---	---
14	---	---	---	---
Goliad:				
15, 17	40	325	---	3.0
16, 18	35	275	---	2.5
Lacoste:				
[2]19:				
Lacoste part	30	---	---	3.5
Olmos part	---	---	---	---
Lattas:				
20	60	400	15	4.0
21	50	350	10	3.5
Leming:				
22	65	350	---	---
Miguel:				
23	30	200	7	---
Odem:				
24	55	300	---	---
Oil-Waste land:				
25	---	---	---	---
Olmos:				
[2]26	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Grain sorghum	Cotton lint	Flax	Pasture
	Bu	Lb	Bu	AUM[1]
Opelika:				
27	35	200	8	4.0
28	30	200	7	4.0
Papagua:				
[2]29	45	250	---	4.0
Papalote:				
30	40	200	7	5.0
31	45	250	8	5.5
Parrita:				
32	25	---	---	2.0
Pernitas:				
33, 35	25	200	---	2.5
34	40	300	---	3.0
36	---	---	---	2.0
Pettus:				
37	25	---	---	2.0
38	20	---	---	1.5
39	---	---	---	1.0
Pharr:				
40, 42	65	450	---	---
41, 43	45	400	---	---
Pits:				
44	---	---	---	---
Racombes:				
45	65	500	---	---
Runge:				
46, 49	55	250	14	---
47, 50	50	250	12	---
48	45	200	10	---
Sarita:				
51	---	---	---	---
Sinton:				
52	70	350	---	---

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

[2]This map unit is made up of two or more kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	284,362	80,605	29,280	85,622	88,855
III	206,842	95,449	108,797	2,596	---
IV	10,731	10,731	---	---	---
V	14,166	---	14,166	---	---
VI	3,599	3,599	---	---	---
VII	20,597	---	---	20,597	---
VIII	---	---	---	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1, 2 Aransas	Clayey Bottomland	Favorable	8,000	Virginia wildrye	10
		Normal	6,500	Little bluestem	10
		Unfavorable	4,500	Switchgrass	10
				Fourflower trichloris	10
				Indiangrass	10
				Vine-mesquite	10
				Buffalograss	10
				Panicum	5
3 Clareville	Clay Loam	Favorable	5,800	Twoflower trichloris	13
		Normal	5,000	Fourflower trichloris	12
		Unfavorable	3,000	Little bluestem	10
				Pinhole bluestem	10
				Plains bristlegrass	10
				Buffalograss	10
				Pink pappusgrass	10
				Arizona cottontop	5
				Sideoats grama	5
4 Comitas	Loamy Sand	Favorable	4,500	Little bluestem	20
		Normal	3,500	Crinkleawn	10
		Unfavorable	2,000	Switchgrass	10
				Arizona cottontop	10
				Plains bristlegrass	10
				Tanglehead	5
				Sideoats grama	5
				Hooded windmillgrass	5
				Fall witchgrass	5
				Pink pappusgrass	5
5, 6 Czar	Sandy Loam	Favorable	5,000	Little bluestem	20
		Normal	4,000	Fourflower trichloris	20
		Unfavorable	3,000	Arizona cottontop	20
				Plains bristlegrass	10
				Hooded windmillgrass	5
				Nash windmillgrass	5
7, 8 Danjer	Blackland	Favorable	4,000	Plains bristlegrass	20
		Normal	3,500	Sideoats grama	10
		Unfavorable	3,000	Vine-mesquite	10
				Texas cupgrass	10
				Arizona cottontop	10
				Plains lovegrass	10
				Fourflower trichloris	5
				Curlymesquite	5
9 Delfina	Loamy Sand	Favorable	4,500	Little bluestem	40
		Normal	3,800	Arizona cottontop	10
		Unfavorable	2,000	Plains bristlegrass	10
				Tanglehead	5
				Sideoats grama	5
				Hooded windmillgrass	5
				Pink pappusgrass	5
10, 11 Delfina	Tight Sandy Loam	Favorable	3,500	Twoflower trichloris	10
		Normal	3,000	Hooded windmillgrass	10
		Unfavorable	1,000	Pink pappusgrass	10
				Buffalograss	10
				Sideoats grama	8
				Fourflower trichloris	7
				Tanglehead	7
				Plains bristlegrass	7
				Plains lovegrass	7
				Arizona cottontop	6
				Fringeleaf paspalum	5

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
12: Delmita	Sandy Loam	Favorable	4,000	Arizona cottontop	15
		Normal	3,000	Tanglehead	15
		Unfavorable	1,500	Plains lovegrass	15
				Hooded windmillgrass	10
				Purple threeawn	5
				Fringeleaf paspalum	5
				Slim tridens	5
13: Edroy	Claypan Prairie	Favorable	5,000	Twoflower trichloris	20
		Normal	4,000	Plains bristlegrass	10
		Unfavorable	2,500	Buffalograss	8
				Arizona cottontop	7
				Vine-mesquite	7
				Pink pappusgrass	7
				Sideoats grama	7
				Little bluestem	6
14: Edroy	Lakebed	Favorable	5,000	Hartweg paspalum	40
		Normal	4,000	Spike lovegrass	10
		Unfavorable	3,000	White tridens	10
				Buffalograss	5
				Knotroot panicum	5
15, 16: Goliad	Sandy Loam	Favorable	5,500	Fourflower trichloris	25
		Normal	4,200	Little bluestem	10
		Unfavorable	3,000	Pinhole bluestem	10
				Plains bristlegrass	10
				Pink pappusgrass	10
				Arizona cottontop	5
				Sideoats grama	5
				Curlymesquite	5
17, 18: Goliad	Clay Loam	Favorable	5,000	Fourflower trichloris	30
		Normal	4,100	Little bluestem	10
		Unfavorable	3,000	Pinhole bluestem	10
				Plains bristlegrass	10
				Arizona cottontop	10
				Hooded windmillgrass	10
19*:					
Lacoste	Shallow Sandy Loam	Favorable	3,700	Silver bluestem	10
		Normal	2,800	Tanglehead	10
		Unfavorable	1,500	Arizona cottontop	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Fall witchgrass	8
				Slim tridens	7
				Pink pappusgrass	5
				Sand dropseed	5
Olmos	Shallow Ridge	Favorable	2,500	Sideoats grama	25
		Normal	1,800	Silver bluestem	10
		Unfavorable	1,000	Plains bristlegrass	10
				Tanglehead	10
				Arizona cottontop	5
				Plains lovegrass	5
				Twoflower trichloris	5
				Pink pappusgrass	5
				Slim tridens	5
				Wright threeawn	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
20, 21 Lattas	Blackland	Favorable	4,500	Little bluestem	15
		Normal	4,000	Fourflower trichloris	15
		Unfavorable	3,000	Indiangrass	10
				Arizona cottontop	10
				Sideoats grama	10
				Buffalograss	10
				Pinhole bluestem	5
				Pink pappusgrass	5
				Plains bristlegrass	5
				Vine-mesquite	5
				Nash windmillgrass	5
22 Leming	Sandy	Favorable	4,500	Little bluestem	20
		Normal	4,000	Crinkleawn	10
		Unfavorable	2,000	Switchgrass	10
				Arizona cottontop	10
				Brownseed paspalum	5
				Sideoats grama	5
				Hooded windmillgrass	5
				Knotroot panicum	5
				Plains bristlegrass	5
				Pink pappusgrass	5
23 Miguel	Tight Sandy Loam	Favorable	4,500	Little bluestem	15
		Normal	3,500	Fourflower trichloris	10
		Unfavorable	2,000	Silver bluestem	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
				Buffalograss	10
				Tanglehead	5
				Plains bristlegrass	5
				Plains lovegrass	5
				Wright threeawn	5
24 Odem	Loamy Bottomland	Favorable	7,000	Fourflower trichloris	15
		Normal	6,000	Seacoast bluestem	15
		Unfavorable	4,000	Vine-mesquite	10
				Big sandbur	5
				Switchgrass	5
				Southwestern bristlegrass	5
				Texas needlegrass	5
				Virginia wildrye	5
				White tridens	5
				Sideoats grama	5
				Pink pappusgrass	5
26* Olmos	Shallow Ridge	Favorable	2,500	Sideoats grama	25
		Normal	1,800	Silver bluestem	10
		Unfavorable	1,000	Plains bristlegrass	10
				Tanglehead	10
				Arizona cottontop	5
				Plains lovegrass	5
				Twoflower trichloris	5
				Pink pappusgrass	5
				Slim tridens	5
				Wright threeawn	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
27, 28. Opelika	Claypan Prairie	Favorable	5,000	Twoflower trichloris	15
		Normal	4,000	Fourflower trichloris	10
		Unfavorable	2,500	Plains bristlegrass	10
				Buffalograss	8
				Arizona cottontop	7
				Pink pappusgrass	7
				Sideoats grama	7
				Vine-mesquite	7
				Pinhole bluestem	7
				Curlymesquite	7
				Hooded windmillgrass	5
				Lovegrass tridens	5
29*. Papagua	Ramadero	Favorable	5,200	Fourflower trichloris	30
		Normal	3,500	Arizona cottontop	10
		Unfavorable	2,500	Hooded windmillgrass	10
				Sideoats grama	5
				Lovegrass tridens	5
				Plains bristlegrass	5
				Fall witchgrass	5
				Vine-mesquite	5
				Wright threeawn	5
30. Papalote	Loamy Sand	Favorable	4,500	Little bluestem	30
		Normal	3,900	Arizona cottontop	10
		Unfavorable	2,000	Plains bristlegrass	10
				Switchgrass	10
				Tanglehead	5
				Hooded windmillgrass	5
				Sideoats grama	5
31. Papalote	Tight Sandy Loam	Favorable	4,800	Little bluestem	20
		Normal	4,000	Fourflower trichloris	10
		Unfavorable	2,000	Hooded windmillgrass	10
				Sideoats grama	7
				Arizona cottontop	5
				Tanglehead	5
				Lovegrass tridens	5
				Plains bristlegrass	5
				Plains lovegrass	5
32. Parrita	Shallow Sandy Loam	Favorable	3,700	Fall witchgrass	15
		Normal	3,000	Arizona cottontop	10
		Unfavorable	1,200	Plains bristlegrass	10
				Red grama	10
				Tanglehead	10
				Pinhole bluestem	10
				Pink pappusgrass	10
				Hooded windmillgrass	5
				Slim tridens	5
33, 34, 35, 36. Pernitas	Gray Sandy Loam	Favorable	4,500	Fourflower trichloris	20
		Normal	3,500	Lovegrass tridens	15
		Unfavorable	2,500	Pink pappusgrass	10
				Plains bristlegrass	10
				Hooded windmillgrass	10
				Arizona cottontop	5
				Fall witchgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo-sition
			Lb/acre		Pct
37, 38, 39: Pettus	Shallow Ridge	Favorable	3,200	Arizona cottontop	20
		Normal	2,700	Sideoats grama	10
		Unfavorable	1,500	Little bluestem	10
				Twoflower trichloris	10
				Tanglehead	10
				Pinhole bluestem	5
				Green sprangletop	5
				Slim tridens	5
				Fall witchgrass	5
				Hairy grama	5
				Curlymesquite	5
40, 41, 42, 43: Pharr	Gray Sandy Loam	Favorable	4,800	Twoflower trichloris	10
		Normal	4,000	Fourflower trichloris	10
		Unfavorable	2,500	Plains bristlegrass	10
				Hooded windmillgrass	10
				Pink pappusgrass	10
				Green sprangletop	8
				Lovegrass tridens	7
45: Racombes	Clay Loam	Favorable	6,000	Fourflower trichloris	40
		Normal	5,000	Arizona cottontop	10
		Unfavorable	2,500	Sideoats grama	10
				Lovegrass tridens	5
				Hooded windmillgrass	5
				Plains bristlegrass	5
				Buffalograss	5
				Vine-mesquite	5
				Pink pappusgrass	5
46, 47, 48, 49, 50: Runge	Sandy Loam	Favorable	5,400	Little bluestem	20
		Normal	4,800	Fourflower trichloris	10
		Unfavorable	3,000	Twoflower trichloris	10
				Arizona cottontop	10
				Plains bristlegrass	10
				Pink pappusgrass	10
				Mesquite	5
51: Sarita	Sandy	Favorable	5,000	Seacoast bluestem	50
		Normal	4,000	Brownseed paspalum	5
		Unfavorable	2,000	Indiangrass	5
				Switchgrass	5
				Tanglehead	5
				Fringeleaf paspalum	5
				Hooded windmillgrass	5
52: Sinton	Loamy Bottomland	Favorable	7,000	Fourflower trichloris	15
		Normal	6,000	Little bluestem	15
		Unfavorable	4,000	Vine-mesquite	10
				Switchgrass	5
				Southwestern bristlegrass	5
				Texas wintergrass	5
				Virginia wildrye	5
				White tridens	5
				Sideoats grama	5
				Buffalograss	5
				Pink pappusgrass	5
				Plains bristlegrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aransas:					
1, 2	Severe: floods, too clayey, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.
Clareville:					
3	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Comitas:					
4	Moderate: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
Czar:					
5, 6	Slight	Slight	Slight	Slight	Moderate: low strength.
Danjer:					
7, 8	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Delfina:					
9, 10, 11	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Delmita:					
12	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
Edroy:					
13, 14	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.
Goliad:					
15, 16, 17, 18	Moderate: cemented pan.	Moderate: shrink-swell.	Moderate: shrink-swell, cemented pan.	Moderate: shrink-swell, cemented pan.	Moderate: shrink-swell, low strength.
Lacoste:					
[1]19:					
Lacoste part	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.
Olmos part	Severe: cemented pan, small stones.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.
Lattas:					
20, 21	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Leming:					
22	Moderate: too clayey, cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Miguel:					
23	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Odem:					
24	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Oil-Waste land:					
25	---	---	---	---	---
Olmos:					
[1]26	Severe: cemented pan, small stones.	Moderate: cemented pan, large stones.	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.
Opelika:					
27	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: low strength.
28	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: low strength, floods.
Papagua:					
[1]29	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, shrink-swell.
Papalote:					
30, 31	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: corrosive, shrink-swell.	Moderate: low strength, shrink-swell.
Parrita:					
32	Severe: cemented pan.	Moderate: cemented pan, low strength.	Moderate: cemented pan, low strength.	Moderate: cemented pan, low strength.	Moderate: cemented pan, low strength.
Pernitas:					
33, 34, 35, 36	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
Pettus:					
37, 38, 39	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: low strength.
Pharr:					
40, 41, 42, 43	Slight	Slight	Slight	Slight	Moderate: low strength.
Pits:					
44	---	---	---	---	---
Racombes:					
45	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
Runge:					
46, 47, 48, 49, 50	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sarita:					
51	Severe: too sandy, cutbanks cave.	Slight	Moderate: low strength, shrink-swell.	Slight	Moderate: low strength.
Sinton:					
52	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aransas:					
1, 2	Severe: percs slowly, floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Clareville:					
3	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Comitas:					
4	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Czar:					
5, 6	Slight	Moderate: seepage.	Slight	Slight	Good.
Danjer:					
7	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
8	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Delfina:					
9	Moderate: percs slowly.	Slight	Slight	Slight	Fair: too sandy.
10	Moderate: percs slowly.	Slight	Slight	Slight	Good.
11	Moderate: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Delmita:					
12	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Fair: thin layer.
Edroy:					
13, 14	Severe: percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
Goliad:					
15, 16, 17, 18	Severe: cemented pan, percs slowly.	Severe: cemented pan.	Moderate: cemented pan, too clayey.	Slight	Fair: thin layer.
Lacoste:					
[1]19:					
Lacoste part	Severe: cemented pan.	Severe: cemented pan, seepage.	Severe: cemented pan.	Slight	Poor: thin layer.
Olmos part	Severe: cemented pan.	Severe: cemented pan, small stones.	Severe: cemented pan, small stones.	Slight	Poor: cemented pan, small stones.
Lattas:					
20, 21	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Leming:					
22	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too sandy.
Miguel:					
23	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Odem:					
24	Severe: floods.	Severe: floods, seepage.	Severe: floods.	Severe: floods, seepage.	Good.
Oil-Waste land:					
25	---	---	---	---	---
Olmos:					
[1]26	Severe: cemented pan.	Severe: cemented pan, small stones.	Severe: cemented pan, small stones.	Slight	Poor: cemented pan, small stones.
Opelika:					
27	Severe: percs slowly.	Slight	Moderate: wetness, floods.	Moderate: wetness, floods.	Good.
28	Severe: percs slowly, floods.	Slight	Severe: floods.	Severe: floods.	Good.
Papagua:					
[1]29	Severe: percs slowly.	Slight	Moderate: wetness, floods.	Moderate: floods.	Fair: too clayey.
Papalote:					
30, 31	Severe: percs slowly.	Slight	Slight	Slight	Good.
Parrita:					
32	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Poor: thin layer.
Pernitas:					
33, 34, 35 36	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Pettus:					
37, 38, 39	Slight	Moderate: seepage.	Slight	Slight	Poor: thin layer.
Pharr:					
40, 42	Slight	Moderate: seepage.	Slight	Slight	Good.
41, 43	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Pits:					
44	---	---	---	---	---
Racombes:					
45	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Runge:					
46, 49	Slight	Moderate: seepage.	Slight	Slight	Good.
47, 48, 50	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Sarita:					
51	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
Sinton:					
52	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aransas:				
1, 2	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Clareville:				
3	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Comitas:				
4	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Czar:				
5, 6	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Danjer:				
7, 8	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Delfina:				
9	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
10, 11	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Delmita:				
12	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Edroy:				
13, 14	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Goliad:				
15, 16, 17, 18	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Lacoste:				
[1]19:				
Lacoste part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Olmos part	Poor: cemented pan, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Lattas:				
20, 21	Severe: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Leming:				
22	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Miguel:				
23	Fair: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Odem:				
24	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
Oil-Waste land:				
25	---	---	---	---
Olmos:				
[1]26	Poor: cemented pan, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Opelika:				
27, 28	Severe: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Papagua:				
[1]29	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Papalote:				
30	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
31	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Parrita:				
32	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Pernitas:				
33	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, excess lime.
34, 35, 36	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
Pettus:				
37, 38, 39	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime, thin layer.
Pharr:				
40, 41	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
42, 43	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Pits:				
44	---	---	---	---
Racombes:				
45	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Runge:				
46, 47, 48, 49, 50	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Sarita:				
51	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Sinton:				
52	Moderate: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Aransas: 1, 2	Slight	Moderate: compressible, low strength.	Percs slowly, floods, wetness.	Slow intake, floods, wetness.	Percs slowly, floods, wetness.	Percs slowly, wetness.
Clareville: 3	Moderate: seepage.	Moderate: compressible.	Percs slowly	Percs slowly	Favorable	Favorable.
Comitas: 4	Severe: seepage.	Moderate: piping.	Not needed	Fast intake, droughty.	Too sandy	Droughty, erodes easily.
Czar: 5, 6	Moderate: seepage.	Moderate: compressible.	Favorable	Favorable	Favorable	Favorable.
Danjer: 7, 8	Slight	Moderate: compressible, unstable fill.	Percs slowly, cutbanks cave.	Slow intake	Percs slowly	Percs slowly.
Delfina: 9, 10, 11	Moderate: seepage.	Slight	Favorable	Favorable	Favorable	Favorable.
Delmita: 12	Severe: cemented pan.	Moderate: thin layer.	Cemented pan	Rooting depth	Cemented pan	Rooting depth.
Edroy: 13, 14	Moderate: seepage, thin layer.	Moderate: compressible.	Floods, percs slowly.	Percs slowly, floods, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Goliad: 15, 16, 17, 18	Severe: cemented pan, seepage.	Moderate: thin layer, compressible.	Not needed	Thin layer	Cemented pan	Favorable, erodes easily.
Lacoste: [1]19:						
Lacoste part	Severe: cemented pan, seepage.	Severe: thin layer.	Cemented pan	Droughty, rooting depth.	Cemented pan	Droughty, rooting depth.
Olmos part	Severe: cemented pan.	Severe: thin layer, large stones.	Not needed	Thin layer, excess lime.	Cemented pan	Not needed.
Lattas: 20, 21	Slight	Moderate: compressible, unstable fill.	Percs slowly, cutbanks cave.	Slow intake	Percs slowly	Percs slowly.
Leming: 22	Slight	Moderate: piping.	Percs slowly	Droughty, erodes easily.	Too sandy	Droughty, too sandy.
Miguel: 23	Slight	Slight	Percs slowly	Slow intake	Favorable	Percs slowly.
Odem: 24	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Fast intake, seepage.	Not needed	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Oil-Waste land: 25	---	---	---	---	---	---
Olmos: [1]26	Severe: cemented pan.	Severe: thin layer, large stones.	Not needed	Thin layer, excess lime.	Cemented pan	Not needed.
Opelika: 27, 28	Moderate: seepage.	Moderate: compressible.	Percs slowly	Slow intake	Favorable	Favorable.
Papagua: [1]29	Moderate: seepage.	Slight	Percs slowly	Slow intake	Favorable	Favorable.
Papalote: 30, 31	Moderate: seepage.	Slight	Percs slowly	Favorable	Favorable	Favorable.
Parrita: 32	Severe: cemented pan, seepage.	Severe: thin layer.	Not needed	Rooting depth	Cemented pan, rooting depth.	Rooting depth.
Pernitas: 33, 34, 35, 36	Moderate: seepage.	Moderate: compressible, shrink-swell.	Not needed	Excess lime, seepage.	Favorable	Favorable.
Pettus: 37, 38, 39	Severe: seepage.	Moderate: thin layer, seepage.	Not needed	Excess lime, seepage, rooting depth.	Cemented pan, droughty.	Droughty, rooting depth.
Pharr: 40, 41, 42, 43	Moderate: seepage.	Moderate: compressible.	Favorable	Favorable	Favorable	Favorable.
Pits: 44	---	---	---	---	---	---
Racombes: 45	Moderate: seepage.	Moderate: compressible, seepage.	Favorable	Favorable	Not needed	Not needed.
Runge: 46, 47, 48, 49, 50	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable	Favorable.
Sarita: 51	Severe: seepage.	Severe: seepage, unstable fill.	Not needed	Fast intake, droughty.	Too sandy	Droughty.
Sinton: 52	Severe: seepage.	Moderate: compressible, piping.	Floods	Floods	Favorable	Favorable.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 13.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aransas:				
1, 2	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.
Clareville:				
3	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Comitas:				
4	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Czar:				
5	Slight	Slight	Slight	Slight.
6	Slight	Slight	Moderate: slope.	Slight.
Danjer:				
7, 8	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Delfina:				
9	Moderate: percs slowly, too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
10	Moderate: percs slowly.	Slight	Slight	Slight.
11	Moderate: percs slowly.	Slight	Moderate: slope.	Slight.
Delmita:				
12	Slight	Slight	Moderate: cemented pan.	Slight.
Edroy:				
13, 14	Severe: wetness, floods, too clayey.	Severe: wetness, floods, too clayey.	Severe: wetness, floods, too clayey.	Severe: wetness, floods, too clayey.
Goliad:				
15	Slight	Slight	Slight	Slight.
16	Slight	Slight	Moderate: slope.	Slight.
17, 18	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Lacoste:				
[1]19:				
Lacoste part	Slight	Slight	Severe: cemented pan.	Slight.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lacoste:				
Olmos part	Severe: small stones, large stones.	Severe: small stones, large stones.	Severe: small stones, large stones.	Severe: small stones, large stones.
Lattas:				
20, 21	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Leming:				
22	Moderate: too sandy, percs slowly.	Moderate: too sandy.	Moderate: too sandy, percs slowly.	Moderate: too sandy.
Miguel:				
23	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Odem:				
24	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Oil-Waste land:				
25	---	---	---	---
Olmos:				
[1]26	Severe: small stones, large stones.	Severe: small stones, large stones.	Severe: small stones, large stones.	Severe: small stones, large stones.
Opelika:				
27, 28	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Papagua:				
[1]29	Moderate: too sandy, wetness, percs slowly.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy, percs slowly.	Moderate: too sandy.
Papalote:				
30	Moderate: percs slowly, too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
31	Moderate: percs slowly.	Slight	Slight	Slight.
Parrita:				
32	Moderate: too clayey.	Moderate: too clayey.	Severe: cemented pan.	Moderate: too clayey.
Pernitas:				
33	Slight	Slight	Moderate: slope.	Slight.
34	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
35	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
36	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Pettus:				
37	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
38, 39	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey, slope.	Moderate: too clayey.
Pharr:				
40	Slight	Slight	Slight	Slight.
41	Slight	Slight	Moderate: slope.	Slight.
42	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
43	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Pits:				
44	---	---	---	---
Racombes:				
45	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Runge:				
46	Slight	Slight	Slight	Slight.
47, 48	Slight	Slight	Moderate: slope.	Slight.
49	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
50	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Sarita:				
51	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Sinton:				
52	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements--						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Aransas:									
1	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair	Fair.
2	Very poor	Poor	Fair	Fair	Poor	Good	Poor	Fair	Fair.
Clareville:									
3	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
Comitas:									
4	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Czar:									
5, 6	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Danjer:									
7	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
8	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Delfina:									
9, 10, 11	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Delmita:									
12	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Edroy:									
13	Fair	Fair	Poor	Poor	Poor	Good	Fair	Fair	Poor.
14	Very poor	Poor	Poor	Poor	Poor	Good	Poor	Fair	Poor.
Goliad:									
15, 17	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
16, 18	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Lacoste:									
[1]19:									
Lacoste part	Poor	Fair	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Olmos part	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Lattas:									
20, 21	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Leming:									
22	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Miguel:									
23	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
Odem:									
24	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
Oil-Waste land:									
25	---	---	---	---	---	---	---	---	---
Olmos:									
[1]26	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Opelika:									
27, 28	Fair	Fair	Good	Good	Fair	Fair	Fair	Fair	Good.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements--						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Papagua:									
[1]29	Fair	Fair	Fair	Good	Fair	Poor	Fair	Poor	Fair.
Papalote:									
30, 31	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Parrita:									
32	Fair	Good	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
Pernitas:									
33, 35	Fair	Good	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
34	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
36	Poor	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
Pettus:									
37, 38, 39	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Pharr:									
40, 41, 42, 43	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Pits:									
44	---	---	---	---	---	---	---	---	---
Racombes:									
45	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Runge:									
46, 47, 48, 49, 50	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Sarita:									
51	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
Sinton:									
52	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Aransas:											
1, 2	0-65	Clay	CH	A-7-6	0	100	95-100	95-100	75-95	51-75	30-50
Clareville:											
3	0-11	Loam	CL, SC	A-6, A-7	0	98-100	95-100	90-100	45-70	32-48	15-27
	11-38	Clay loam, clay, sandy clay.	CL, CH	A-7	0	98-100	95-100	90-100	51-80	46-60	25-37
	38-64	Clay loam, loam	CL, CH	A-6, A-7	0	95-100	85-100	85-100	51-75	36-52	17-30
Comitas:											
4	0-32	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-25	<25	NP-4
	32-75	Fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0	95-100	90-100	80-95	30-50	<34	NP-14
Czar:											
5, 6	0-13	Fine sandy loam	SM-SC, SC	A-2-4, A-4	0	100	100	90-100	30-50	<30	4-11
	13-68	Sandy clay loam, fine sandy loam.	SC, CL	A-6	0	97-100	90-100	85-95	36-55	30-39	11-18
Danjer:											
7, 8	0-6	Clay	CH	A-7-6	0	95-100	95-100	90-100	75-95	52-70	30-45
	6-65	Clay, clay loam	CH	A-7-6	0	95-100	95-100	90-100	70-95	52-70	30-45
Delfina:											
9	0-11	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	100	100	85-100	20-45	<25	NP-7
	11-30	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	100	100	90-100	40-55	34-44	14-22
	30-80	Sandy clay loam, fine sandy loam.	SC	A-6	0	90-100	75-95	70-90	36-50	30-40	11-20
10, 11	0-12	Fine sandy loam	SM-SC, SC	A-2-4, A-4	0	100	100	90-100	25-50	20-30	4-10
	12-36	Sandy clay loam, clay loam.	SC, CL	A-6, A-7	0	100	100	90-100	40-55	34-44	14-22
	36-80	Sandy clay loam, fine sandy loam.	SC	A-6	0	90-100	75-95	70-90	36-50	30-40	11-20
Delmita:											
12	0-10	Fine sandy loam	SM, SM-SC	A-2-4	0	100	100	90-100	20-35	<27	NP-7
	10-30	Sandy clay loam, fine sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	0	100	100	95-100	30-50	27-39	8-18
	30-32	Indurated	---	---	---	---	---	---	---	---	---
Edroy:											
13, 14	0-18	Clay	CH	A-7-6	0	100	100	90-100	75-95	51-60	27-35
	18-42	Clay loam, clay, sandy clay.	CL, CH	A-7-6	0	100	95-100	90-100	70-90	41-55	20-30
	42-53	Sandy clay loam, clay loam, loam.	SC, CL	A-7-6, A-6	0	100	95-100	80-95	40-55	30-42	11-20
	53-72	Variable	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Goliad:											
15, 16	0-11	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	100	70-100	36-50	<30	NP-10
	11-15	Sandy clay loam, sandy clay, clay loam.	SC, CL	A-7-6	0	95-100	90-100	85-100	45-70	41-48	20-26
	15-28	Sandy clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	85-100	80-100	51-80	45-57	22-32
	28-32	Cemented	---	---	---	---	---	---	---	---	---
17, 18	0-11	Sandy clay loam	SC, CL	A-6	0	100	100	75-100	40-65	30-39	11-18
	11-15	Sandy clay loam, sandy clay, clay loam.	SC, CL	A-7-6	0	95-100	90-100	85-100	45-70	41-48	20-26
	15-28	Sandy clay, clay, clay loam.	CL, CH	A-7-6	0	95-100	85-100	80-100	51-80	45-57	22-32
	28-32	Cemented	---	---	---	---	---	---	---	---	---
Lacoste:											
[1]19:											
Lacoste part	0-7	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0-5	80-100	80-100	65-85	30-45	<25	NP-7
	7-12	Sandy clay loam, fine sandy loam, gravelly sandy clay loam.	SC, CL	A-2-4, A-2-6, A-4, A-6	0-5	75-100	70-100	65-90	30-55	25-35	8-15
	12-15	Cemented	---	---	---	---	---	---	---	---	---
Olmos part	0-9	Gravelly loam	GC, GM-GC, SC, SM-SC	A-2-4, A-2-6	0-30	35-75	25-65	25-55	20-35	25-35	7-15
	9-35	Cemented	---	---	---	---	---	---	---	---	---
Lattas:											
20, 21	0-5	Clay	CH, SC, CL	A-7-6	0	100	95-100	85-100	45-85	41-60	20-36
	5-70	Clay, silty clay, clay loam.	CH	A-7-6	0	100	90-100	85-100	70-90	51-70	28-45
Leming:											
22	0-24	Loamy fine sand	SM-SC, SM	A-2-4	0	95-100	95-100	50-75	20-35	<30	NP-7
	24-55	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	95-100	80-95	45-60	41-55	20-30
	55-65	Sandy clay loam, sandy clay, clay loam.	CL, SC	A-6, A-7-6	0-10	95-100	90-100	80-95	40-60	30-45	11-25
Miguel:											
23	0-10	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	95-100	90-100	15-45	<25	NP-7
	10-33	Sandy clay, clay	CL, SC, CH	A-7-6	0	95-100	95-100	90-100	45-70	41-55	20-32
	33-60	Sandy clay loam, sandy clay.	CL, SC	A-6, A-7-6	0	95-100	90-100	90-100	38-70	30-45	15-28
Odem:											
24	0-72	Fine sandy loam	SM-SC, SM	A-2-4	0	100	100	90-100	20-30	<25	NP-7
Oil-Waste land:											
25	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Olmos:											
[1]26----------------	0-9	Gravelly loam---	GC, GM-GC, SC, SM-SC	A-2-4, A-2-6	0-30	35-75	25-65	25-55	20-35	25-35	7-15
	9-35	Cemented--------	---	---	---	---	---	---	---	---	---
Opelika:											
27, 28------------	0-4	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	95-100	90-100	30-40	<30	NP-7
	4-10	Sandy clay, sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	90-100	45-55	35-50	22-35
	10-60	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	---	90-100	90-100	85-100	45-62	35-50	22-35
Papagua:											
[1]29----------------	0-16	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	90-100	50-75	15-35	<25	NP-7
	16-30	Sandy clay------	SC, CL	A-7-6	0	95-100	95-100	85-95	45-60	43-50	21-30
	30-65	Sandy clay loam, sandy clay.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-95	36-60	30-48	20-28
Papalote:											
30-----------------	0-17	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	90-100	50-100	15-35	<25	NP-6
	17-41	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	90-100	85-100	45-70	41-60	21-35
	41-65	Sandy clay loam, clay loam, sandy clay.	CL, SC	A-6, A-7	0	95-100	80-100	75-95	40-70	38-48	18-31
31-----------------	0-16	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	95-100	95-100	90-100	25-50	<25	NP-8
	16-38	Sandy clay, clay, clay loam.	CL, SC, CH	A-7-6	0	95-100	90-100	85-100	45-70	41-60	21-35
	38-65	Sandy clay loam, clay loam, sandy clay.	CL, SC	A-6, A-7	0	95-100	80-100	75-95	40-70	38-48	18-31
Parrita:											
32-----------------	0-5	Sandy clay loam	SC, CL	A-4, A-6	0	100	100	80-90	40-55	26-35	8-15
	5-9	Sandy clay loam, sandy clay, clay.	CL, CH	A-6, A-7-6	0	100	100	80-95	51-60	38-55	17-30
	9-17	Sandy clay, clay	CL, CH	A-7-6	0	100	100	80-95	55-75	45-59	22-34
	17-24	Cemented--------	---	---	---	---	---	---	---	---	---
Pernitas:											
33-----------------	0-10	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	100	80-100	30-40	<30	NP-7
	10-28	Sandy clay, clay, clay loam.	CL, SC	A-6, A-7-6	0	90-100	85-100	80-99	45-70	33-47	15-30
	28-61	Sandy clay, sandy clay loam.	SC, CL	A-7-6, A-2-7, A-2-6, A-6	0	75-100	70-95	60-92	30-70	35-50	17-27

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pernitas: 34, 35, 36	0-11	Sandy clay loam	SC, CL	A-4, A-6	0	100	100	80-100	36-55	24-37	9-20
	11-30	Sandy clay, clay, clay loam.	CL, SC	A-6, A-7-6	0	90-100	85-100	80-99	45-70	30-47	15-30
	30-72	Sandy clay, sandy clay loam.	SC, CL	A-7-6, A-6	0	75-100	70-99	60-98	36-70	35-50	17-27
Pettus: 37, 38, 39	0-17	Sandy clay loam	CL, SC	A-6, A-7	0	80-100	75-100	55-100	40-65	27-43	11-21
	17-21	Variable, cemented.	---	---	0	---	---	---	---	---	---
	21-65	Stratified gravelly sandy clay loam to gravelly loam.	---	---	---	---	---	---	---	---	---
Pharr: 40, 41	0-9	Fine sandy loam	SM-SC, SC	A-4, A-6	0	100	100	100	36-50	21-30	5-13
	9-65	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	80-100	80-100	36-55	30-40	11-21
42, 43	0-10	Sandy clay loam	SM-SC, SC	A-4, A-6	0	100	100	100	36-50	21-30	5-13
	10-65	Sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	80-100	80-100	36-55	30-40	11-21
Pits: 44	---	---	---	---	---	---	---	---	---	---	---
Racombes: 45	0-11	Sandy clay loam	CL, SC	A-4, A-6	0	100	100	95-100	45-65	27-35	8-15
	11-41	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	100	95-100	90-100	45-65	34-43	15-22
	41-76	Sandy clay loam, clay loam.	CL, SC	A-6	0	90-100	80-100	80-95	40-65	30-40	11-20
Runge: 46, 47, 48	0-14	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	95-100	95-100	25-45	<25	NP-7
	14-72	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	100	90-100	85-100	45-65	30-44	11-22
49, 50	0-12	Sandy clay loam	SC, CL	A-6, A-7-6	0	100	90-100	85-100	45-65	30-44	11-22
	12-70	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	100	90-100	85-100	45-65	30-44	11-22
Sarita: 51	0-63	Loamy fine sand	SM-SC, SP-SM, SM	A-2-4	0	100	100	65-100	9-35	<25	NP-7
	63-80	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6	0	100	100	80-100	30-50	28-40	11-22
Sinton: 52	0-34	Sandy clay loam	CL, SC	A-6	0	100	95-100	80-90	45-55	28-40	11-20
	34-65	Stratified loamy fine sand to sandy clay loam.	SM, SC, ML, CL, SM-SC, ML-CL	A-2-4, A-2-6, A-4, A-6	0	100	90-100	50-70	20-52	<30	NP-14

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH	Mmhos/cm					
Aransas:										
1, 2	0-65	<0.06	0.12-0.18	7.9-8.4	<4	High	High	Low	0.32	5
Clareville:										
3	0-11	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate	Moderate	Low	0.32	5
	11-38	0.2-0.6	0.15-0.20	7.4-8.4	<2	High	High	Low	0.32	
	38-64	0.6-2.0	0.12-0.16	7.9-8.4	<4	Moderate	High	Low	0.32	
Comitas:										
4	0-32	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low	Low	Low	0.17	5
	32-75	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low	Low	Low	0.24	
Czar:										
5, 6	0-13	0.6-2.0	0.09-0.15	6.6-7.8	<2	Low	Low	Low	0.24	5
	13-68	0.6-2.0	0.10-0.18	7.4-8.4	<2	Low	Moderate	Low	0.32	
Danjer:										
7, 8	0-6	0.06-0.2	0.15-0.20	7.9-8.4	<4	High	High	Low	0.32	5
	6-65	<0.06	0.12-0.18	7.9-8.4	<4	High	High	Low	0.32	
Delfina:										
9	0-12	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low	Moderate	Low	0.24	5
	12-36	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate	High	Low	0.32	
	36-80	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate	High	Low	0.32	
10, 11	0-11	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Moderate	Low	0.24	5
	11-30	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate	High	Low	0.32	
	30-80	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate	High	Low	0.32	
Delmita:										
12	0-10	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low	Moderate	Low	0.24	3
	10-30	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low	Moderate	Low	0.28	
	30-32	---	---	---	---	---------	---------	---------	---	
Edroy:										
13, 14	0-18	<0.06	0.10-0.17	7.9-8.4	<8	Very high	High	Low	0.32	5
	18-42	0.06-0.2	0.09-0.17	7.9-8.4	<8	High	High	Low	0.32	
	42-53	0.06-0.2	0.08-0.16	7.9-8.4	<8	Moderate	High	Low	0.37	
	53-72	0.06-2.0	0.05-0.15	7.9-8.4	<8	---------	High	Low	0.43	
Goliad:										
15, 16	0-11	2.0-6.0	0.10-0.15	6.6-8.4	<2	Low	Low	Low	0.17	2
	11-15	0.2-0.6	0.15-0.20	6.6-8.4	<2	Moderate	High	Low	0.24	
	15-28	0.2-0.6	0.15-0.20	7.4-8.4	<2	Moderate	High	Low	0.24	
	28-32	---	---	---	---	---------	---------	---------	---	
17, 18	0-11	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate	Moderate	Low	0.17	2
	11-15	0.2-0.6	0.15-0.20	6.6-8.4	<2	Moderate	High	Low	0.24	
	15-28	0.2-0.6	0.15-0.20	7.4-8.4	<2	Moderate	High	Low	0.24	
	28-32	---	---	---	---	---------	---------	---------	---	
Lacoste:										
[1]19:										
Lacoste part	0-7	0.6-2.0	0.10-0.15	6.6-8.4	<2	Low	Moderate	Low	0.24	1
	7-12	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low	Moderate	Low	0.28	
	12-15	---	---	---	---	---------	---------	---------	---	
Olmos part	0-9	0.6-2.0	0.05-0.10	7.9-8.4	<2	Low	High	Low	0.10	1
	9-25	---	---	---	---	---------	---------	---------	---	
Lattas:										
20, 21	0-5	0.06-0.2	0.12-0.18	7.9-8.4	<4	High	High	Low	0.32	5
	5-70	<0.06	0.15-0.20	7.9-8.4	<4	High	High	Low	0.32	

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
Leming:										
22----------------	0-24	2.0-6.0	0.05-0.10	6.1-7.3	<2	Very low	Low------	Low------	0.20	5
	24-55	0.06-0.2	0.15-0.20	6.1-8.4	<2	Moderate	High-----	Low------	0.32	
	55-65	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	High-----	Low------	0.32	
Miguel:										
23----------------	0-10	2.0-6.0	0.10-0.15	6.1-7.3	<2	Low-------	High-----	Low------	0.43	5
	10-33	<0.06	0.14-0.17	6.6-8.4	<2	Moderate	High-----	Low------	0.32	
	33-60	0.06-0.2	0.12-0.15	7.9-8.4	<2	Moderate	High-----	Low------	0.32	
Odem:										
24----------------	0-72	2.0-6.0	0.10-0.16	6.6-8.4	<2	Low-------	Moderate	Low------	0.24	5
Oil-Waste land:										
25----------------	---	---	---	---	---	---	---	---	---	---
Olmos:										
[1]26---------------	0-9	0.6-2.0	0.05-0.10	7.9-8.4	<2	Low-------	High-----	Low------	0.10	1
	9-35	---	---	---	---	----------	---------	---------	---	
Opelika:										
27, 28------------	0-4	0.6-2.0	0.11-0.17	6.6-7.8	<2	Low-------	Moderate	Low------	0.37	5
	4-10	<0.06	0.12-0.18	6.6-7.8	<2	Moderate	High-----	Low------	0.43	
	10-60	0.06-0.6	0.10-0.15	7.9-8.4	<4	Moderate	High-----	Low------	0.43	
Papagua:										
[1]29---------------	0-16	2.0-6.0	0.07-0.11	6.1-7.3	<2	Low-------	Low------	Low------	0.24	5
	16-30	0.06-0.2	0.14-0.18	6.1-7.3	<2	High------	High-----	Low------	0.32	
	30-65	0.06-0.6	0.12-0.18	7.4-8.4	<2	High------	High-----	Low------	0.37	
Papalote:										
30----------------	0-17	2.0-6.0	0.07-0.11	6.1-7.8	<2	Low-------	Low------	Low------	0.32	5
	17-41	0.06-0.2	0.13-0.18	6.1-8.4	<2	Moderate	High-----	Low------	0.32	
	41-65	0.06-0.2	0.12-0.17	7.9-8.4	<2	Moderate	High-----	Low------	0.32	
31----------------	0-16	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low-------	Low------	Low------	0.32	5
	16-38	0.06-0.2	0.13-0.18	6.1-8.4	<2	Moderate	High-----	Low------	0.32	
	38-65	0.06-0.2	0.12-0.17	7.9-8.4	<2	Moderate	High-----	Low------	0.32	
Parrita:										
32----------------	0-5	0.6-2.0	0.11-0.16	6.6-8.4	<2	Low-------	Moderate	Low------	0.17	2
	5-9	0.6-2.0	0.12-0.17	6.6-8.4	<2	Moderate	High-----	Low------	0.24	
	9-17	0.2-0.6	0.12-0.18	7.4-8.4	<2	Moderate	High-----	Low------	0.24	
	17-24	---	---	---	---	----------	---------	---------	---	
Pernitas:										
33----------------	0-10	0.6-2.0	0.11-0.16	7.9-8.4	<2	Low-------	Moderate	Low------	0.20	3
	10-28	0.6-2.0	0.13-0.18	7.9-8.4	<2	Moderate	High-----	Low------	0.28	
	28-61	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low-------	High-----	Low------	0.32	
34, 35, 36--------	0-11	0.6-2.0	0.11-0.16	7.9-8.4	<2	Low-------	Moderate	Low------	0.20	3
	11-30	0.6-2.0	0.13-0.18	7.9-8.4	<2	Moderate	High-----	Low------	0.28	
	30-72	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low-------	High-----	Low------	0.32	
Pettus:										
37, 38, 39--------	0-17	0.6-2.0	0.10-0.15	7.9-8.4	<2	Low-------	Moderate	Low------	0.24	2
	17-21	0.6-2.0	0.02-0.05	7.9-8.4	<2	Very low	Moderate	Low------	---	
	21-65	0.6-6.0	0.08-0.12	7.9-8.4	<2	Low-------	Moderate	Low------	0.24	
Pharr:										
40, 41, 42, 43----	0-9	0.6-2.0	0.09-0.17	7.9-8.4	<4	Low-------	High-----	Low------	0.24	5
	9-65	0.6-2.0	0.09-0.17	7.9-8.4	<4	Low-------	High-----	Low------	0.32	
Pits:										
44----------------	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH	Mmhos/cm					
Racombes:										
45	0-11	0.6-2.0	0.14-0.19	6.6-7.8	<2	Low	High	Low	0.28	5
	11-41	0.6-2.0	0.15-0.20	6.6-8.4	<2	Moderate	High	Low	0.32	
	41-76	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low	High	Low	0.32	
Runge:										
46, 47, 48	0-14	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	Low	Low	0.24	5
	14-72	0.6-2.0	0.14-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.32	
49, 50	0-12	0.6-2.0	0.14-0.16	6.6-7.8	<2	Moderate	Moderate	Low	0.24	5
	12-70	0.6-2.0	0.14-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.32	
Sarita:										
51	0-63	6.0-20	0.05-0.10	6.1-7.3	<2	Low	Low	Low	0.17	5
	63-80	2.0-6.0	0.13-0.19	6.1-8.4	<2	Moderate	Moderate	Low	0.24	
Sinton:										
52	0-34	0.6-2.0	0.15-0.20	7.9-8.4	<2	Low	Moderate	Low	0.28	5
	34-65	2.0-6.0	0.07-0.15	7.9-8.4	<2	Low	Moderate	Low	---	

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definition of "flooding" in the Glossary explains terms such as "rare" and "brief." Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Cemented pan	
		Frequency	Duration	Months	Depth	Hardness
					In	
Aransas: 1, 2	D	Common	Brief to very long.	Sep-May	---	---
Clareville: 3	C	None	---	---	---	---
Comitas: 4	A	None	---	---	---	---
Czar: 5, 6	B	None	---	---	---	---
Danjer: 7, 8	D	None	---	---	---	---
Delfina: 9, 10, 11	B	None	---	---	---	---
Delmita: 12	C	None	---	---	20-40	Rippable
Edroy: 13, 14	D	Common	Brief to long	Sep-May	---	---
Goliad: 15, 16, 17, 18	C	None	---	---	20-40	Rippable
Lacoste: [1]19:						
Lacoste part	C	None	---	---	10-20	Rippable
Olmos part	C	None	---	---	7-20	Rippable
Lattas: 20, 21	D	None	---	---	---	---
Leming: 22	C	None	---	---	---	---
Miguel: 23	D	None	---	---	---	---
Odem: 24	A	Common	Brief	Sep-May	---	---
Oil-Waste land: 25	---	---	---	---	---	---
Olmos: [1]26	C	None	---	---	7-20	Rippable
Opelika: 27, 28	D	Rare to common	Brief	May-Sep	---	---
Papagua: [1]29	C	Rare	Brief	May-Sep	---	---
Papalote: 30, 31	C	None	---	---	---	---
Parrita: 32	D	None	---	---	12-20	Rippable

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Cemented pan	
		Frequency	Duration	Months	Depth	Hardness
					In	
Pernitas: 33, 34, 35, 36	C	None	---	---	---	---
Pettus: 37, 38, 39	C	None	---	---	11-20	Rippable
Pharr: 40, 41, 42, 43	B	None	---	---	---	---
Pits: 44	---	---	---	---	---	---
Racombes: 45	B	None	---	---	---	---
Runge: 46, 47, 48, 49, 50	B	None	---	---	---	---
Sarita: 51	A	None	---	---	---	---
Sinton: 52	B	Common	Brief	Sep-May	---	---

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING TEST DATA

[Dashes indicate that data were not available. NP means nonplastic. TR means trace]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density		Shrinkage		
			Percentage passing sieve							Percentage smaller than--									
	AASHTO	Unified	7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture	Limit	Linear	Ratio
													Pct		Lb/Ft[3]	Pct	Pct	Pct	Pct
Goliad scl:[3] (S73TX-125-002)																			
A1-------- 0 to 11	A-6 (05)	SC	100	100	100	100	100	100	50	--	23	18	33	18	--	--	17.0	8.1	1.8
B2t-------15 to 28	A-7-6(15)	CL	100	100	100	100	100	100	61	--	38	33	47	29	--	--	15.0	14.5	1.8
Miguel fsl:[4] (S72TX-125-001)																			
Ap-------- 0 to 9	A-2-4(00)	SM-SC	100	100	100	100	100	100	26	--	11	9	22	4	--	--	18.0	2.2	1.7
B22t------13 to 24	A-7-6(12)	CL	100	100	100	100	100	100	51	--	38	37	50	32	--	--	15.0	15.3	1.8
C1--------42 to 70	A-6 (04)	SC	100	100	100	100	99	99	38	--	24	21	36	23	--	--	18.0	8.7	1.7
Opelika fsl:[5] (S72TX-125-007)																			
Ap-------- 0 to 5	A-2-4(00)	SM-SC	100	100	100	100	100	100	33	--	12	10	22	5	--	--	16.0	3.2	1.7
B21t------ 5 to 12	A-6 (06)	SC	100	100	100	100	100	100	47	--	28	25	37	23	--	--	15.0	10.8	1.8
C2ca------44 to 65	A-7-6(11)	CL	100	100	100	100	100	100	52	--	33	27	43	30	--	--	16.0	12.4	1.8
Papalote lfs:[6] (S72TX-125-008)																			
Ap-------- 0 to 8	A-2-4(00)	SM	100	100	100	100	100	100	19	--	6	4	19	3	--	--	17.0	1.3	1.7
B21t------17 to 25	A-7-6(16)	CH	100	100	100	100	100	100	58	--	46	45	52	33	--	--	16.0	15.3	1.8
Cca-------41 to 65	A-7-6(11)	SC	100	100	100	99	97	95	50	--	32	29	46	31	--	--	16.0	13.6	1.8
Parrita scl:[7] (S72TX-125-003)																			
A1-------- 0 to 5	A-6 (05)	SC	100	100	100	100	100	100	50	--	19	15	32	17	--	--	16.0	8.3	1.7
B2t------- 9 to 17	A-7-6(13)	CL	100	100	100	100	100	100	60	--	34	30	44	26	--	--	14.0	13.9	1.8

See footnotes at end of table.

TABLE 18.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Moisture density		Shrinkage		
			Percentage passing sieve							Percentage smaller than--									
	AASHTO	Unified	7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max. dry density	Optimum moisture	Limit	Linear	Ratio
													Pct		Lb/Ft3	Pct	Pct	Pct	Pct
Pernitas scl:[8] (S73TX-125-004)																			
A1------- 0 to 11	A-6 (07)	CL	100	100	100	100	100	100	54	--	23	18	35	19	--	--	16.0	9.2	1.8
B22t-----17 to 30	A-6 (13)	CL	100	100	100	100	99	99	66	--	40	32	40	24	--	--	40.0	12.3	1.8
C2ca-----36 to 72	A-6 (13)	CL	100	100	100	98	95	92	70	--	44	32	39	22	--	--	16.0	11.0	1.8
Pettus scl:[9] (S72TX-125-005)																			
A1------- 0 to 10	A-6 (02)	SC	100	100	100	100	99	97	48	--	19	15	27	12	--	--	15.0	16.2	1.8
B2--------10 to 17	A-6 (06)	CL	100	100	100	99	97	95	57	--	26	20	31	17	--	--	16.0	7.8	1.8
C2ca-----21 to 65	A-6 (07)	CL	100	99	97	91	82	75	56	--	30	19	35	18	--	--	17.0	8.7	1.7

[1]For soil material larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3]Goliad sandy clay loam:
2.7 mi w. of jct. co. rds. 236 & 237, 60 ft sw. in pasture.

[4]Miguel fine sandy loam:
1.7 mi w. of jct. US-281 & FR-625, 0.5 mi n. & 0.5 mi w. on pvt. rd., 40 ft s. in pasture.

[5]Opelika fine sandy loam:
From Alice, 1.8 mi ne. of jct Seven Bridge Rd. & Texas Blvd. & 200 ft se. in field.

[6]Papalote loamy fine sand:
2 mi s. of jct. US-281 & FR-716, 1 mi e. & 50 ft n. in field.

[7]Parrita sandy clay loam:
0.5 mi w. of jct. co. rd. 235 & US-281, 50 ft n. in pasture.

[8]Pernitas sandy clay loam:
4.1 mi w. of jct. co. rds. 236 & 237, & 0.3 mi s. in pasture.

[9]Pettus sandy clay loam:
10 mi n. & 2 mi nw. of jct. co. rd. 236 & US-281, 70 ft sw. in pasture.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aransas	Fine, montmorillonitic (calcareous), hyperthermic Vertic Haplaquolls
Clareville	Fine, montmorillonitic, hyperthermic Pachic Argiustolls
Comitas	Loamy, mixed, hyperthermic Arenic Aridic Haplustalfs
Czar	Fine-loamy, mixed, hyperthermic Pachic Argiustolls
Danjer	Fine, montmorillonitic, hyperthermic Typic Pellusterts
Delfina	Fine-loamy, mixed, hyperthermic Aquic Paleustalfs
Delmita	Fine-loamy, mixed, hyperthermic Petrocalcic Paleustalfs
Edroy	Fine, mixed, hyperthermic Vertic Haplaquolls
Goliad	Fine, mixed, hyperthermic Petrocalcic Paleustolls
Lacoste	Loamy, mixed, hyperthermic, shallow Petrocalcic Paleustalfs
Lattas	Fine, montmorillonitic, hyperthermic Typic Pellusterts
Leming	Clayey, mixed, hyperthermic Aquic Arenic Paleustalfs
Miguel	Fine, mixed, hyperthermic Udic Paleustalfs
Odem	Coarse-loamy, mixed, hyperthermic Cumulic Haplustolls
Olmos	Loamy-skeletal, carbonatic, hyperthermic, shallow Petrocalcic Calciustolls
Opelika	Fine-loamy, mixed, hyperthermic Mollic Albaqualfs
Papagua	Fine, mixed, hyperthermic Typic Albaqualfs
Papalote	Fine, mixed, hyperthermic Aquic Paleustalfs
Parrita	Clayey, mixed, hyperthermic, shallow Petrocalcic Paleustolls
Pernitas	Fine-loamy, mixed, hyperthermic Typic Argiustolls
Pettus	Loamy, mixed, hyperthermic, shallow Typic Calciustolls
Pharr	Fine-loamy, mixed, hyperthermic Typic Argiustolls
Racombes	Fine-loamy, mixed, hyperthermic Pachic Argiustolls
Runge	Fine-loamy, mixed, hyperthermic Typic Argiustolls
Sarita	Loamy, mixed, hyperthermic Grossarenic Paleustalfs
Sinton	Fine-loamy, mixed, hyperthermic Cumulic Haplustolls

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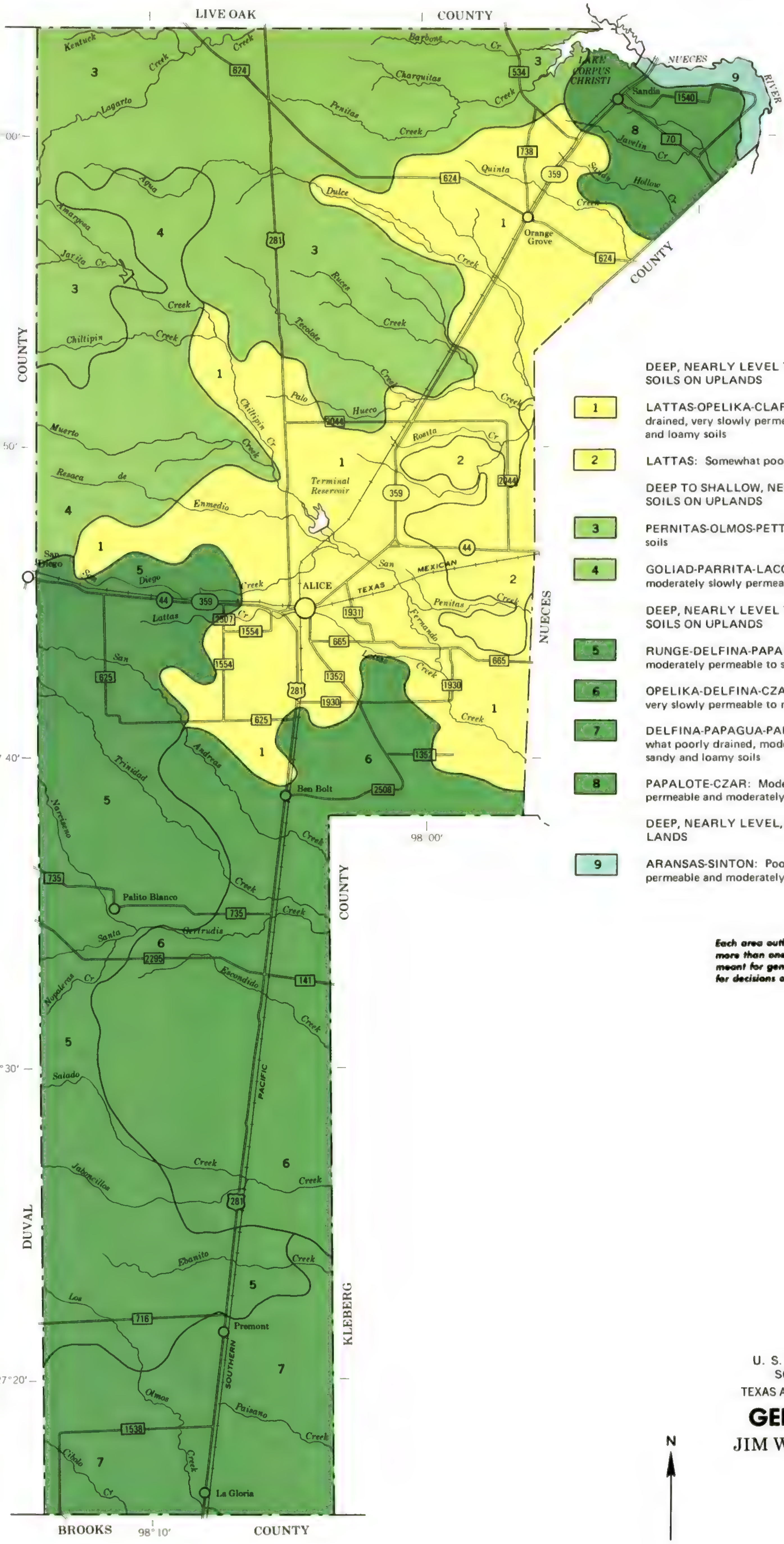


LEGEND

DEEP, NEARLY LEVEL TO GENTLY SLOPING, CLAYEY AND LOAMY SOILS ON UPLANDS

1 LATTAS-OPELIKA-CLAREVILLE: Somewhat poorly drained and well drained, very slowly permeable and moderately slowly permeable, clayey and loamy soils

2 LATTAS: Somewhat poorly drained, very slowly permeable, clayey soils

DEEP TO SHALLOW, NEARLY LEVEL TO GENTLY SLOPING, LOAMY SOILS ON UPLANDS

3 PERNITAS-OLMOS-PETTUS: Well drained, moderately permeable, loamy soils

4 GOLIAD-PARRITA-LACOSTE: Moderately well drained and well drained, moderately slowly permeable and moderately permeable, loamy soils

DEEP, NEARLY LEVEL TO GENTLY SLOPING, LOAMY AND SANDY SOILS ON UPLANDS

5 RUNGE-DELFINA-PAPALOTE: Well drained and moderately well drained, moderately permeable to slowly permeable, loamy soils

6 OPELIKA-DELFINA-CZAR: Somewhat poorly drained to well drained, very slowly permeable to moderately permeable, loamy soils

7 DELFINA-PAPAGUA-PAPALOTE: Moderately well drained and somewhat poorly drained, moderately slowly permeable to slowly permeable, sandy and loamy soils

8 PAPALOTE-CZAR: Moderately well drained and well drained, slowly permeable and moderately permeable, sandy and loamy soils

DEEP, NEARLY LEVEL, CLAYEY AND LOAMY SOILS ON BOTTOM LANDS

9 ARANSAS-SINTON: Poorly drained and well drained, very slowly permeable and moderately permeable, clayey and loamy soils

Compiled 1978

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

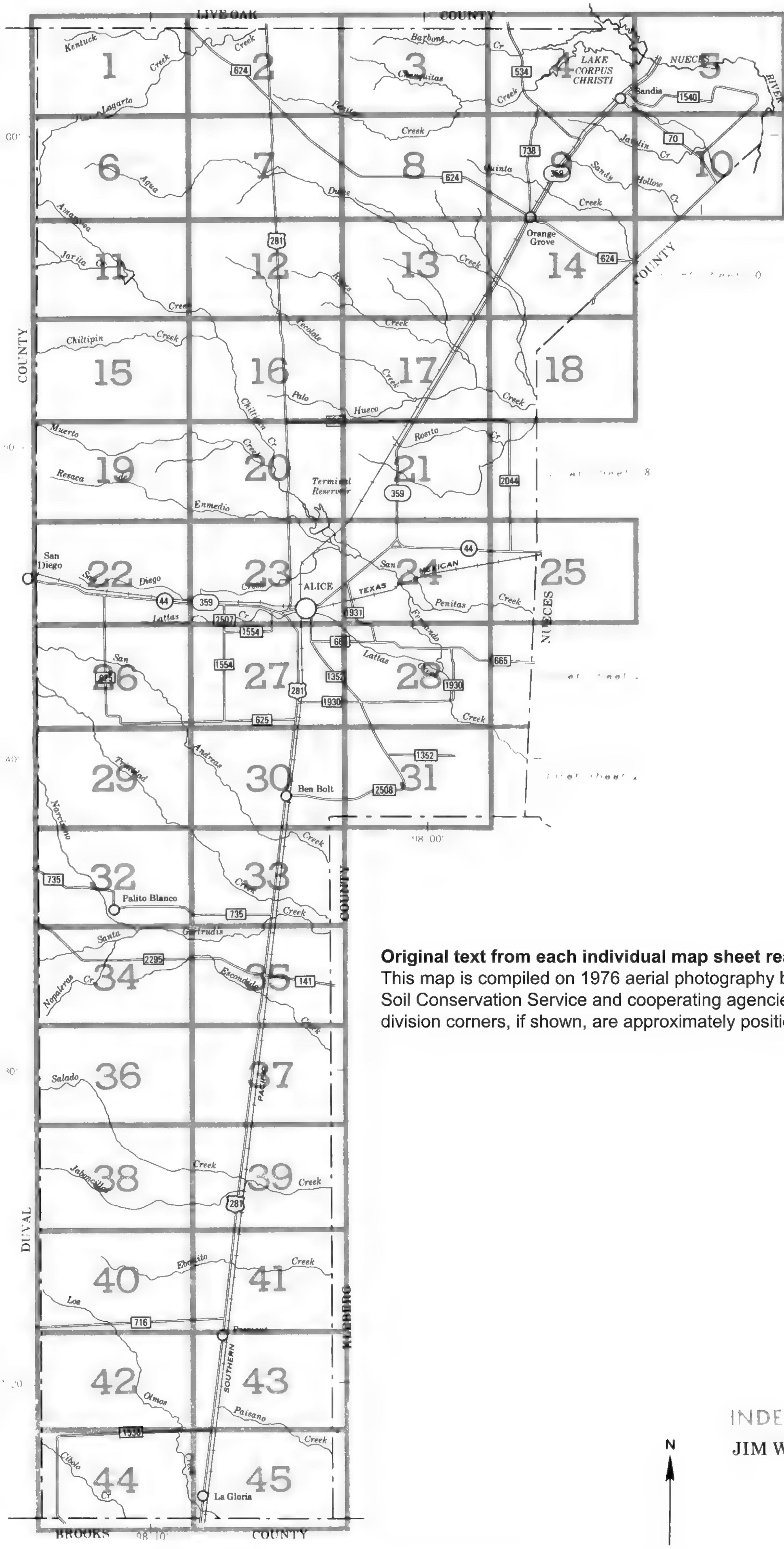
GENERAL SOIL MAP

JIM WELLS COUNTY, TEXAS

N

Scale 1:253,440

1 0 1 2 3 4 Miles



Original text from each individual map sheet read:
This map is compiled on 1976 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

JIM WELLS COUNTY, TEXAS

N

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

Soil names followed by superscript 1/ are broadly defined units. The composition is more variable than that of the others in the survey area but have been controlled well enough to be interpreted for the expected use of the soils

SYMBOL	NAME
1	Aransas Clay
2	Aransas clay, frequently flooded
3	Clareville loam, 0 to 1 percent slopes
4	Comitas loamy fine sand, 0 to 3 percent slopes
5	Czar fine sandy loam, 0 to 1 percent slopes
6	Czar fine sandy loam, 1 to 3 percent slopes
7	Danjer clay, 0 to 1 percent slopes
8	Danjer clay, 1 to 3 percent slopes
9	Delfina loamy fine sand, 0 to 2 percent slopes
10	Delfina fine sandy loam, 0 to 1 percent slopes
11	Delfina fine sandy loam, 1 to 3 percent slopes
12	Delmita fine sandy loam, 1 to 3 percent slopes
13	Edroy clay
14	Edroy clay, depressional
15	Goliad fine sandy loam, 0 to 1 percent slopes
16	Goliad fine sandy loam, 1 to 3 percent slopes
17	Goliad sandy clay loam, 0 to 1 percent slopes
18	Goliad sandy clay loam, 1 to 3 percent slopes
19	Lacoste-Olmos association, gently undulating 1/
20	Lattas clay, 0 to 1 percent slopes
21	Lattas clay, 1 to 3 percent slopes
22	Leming loamy fine sand, 0 to 5 percent slopes
23	Miguel fine sandy loam, 1 to 3 percent slopes
24	Odem fine sandy loam
25	Oil-Waste land
26	Olmos association, undulating 1/
27	Opelika fine sandy loam
28	Opelika fine sandy loam, depressional
29	Papaqua soils, depressional
30	Papalote loamy fine sand, 0 to 3 percent slopes
31	Papalote fine sandy loam, 0 to 1 percent slopes
32	Parrita sandy clay loam, 0 to 3 percent slopes
33	Pernitas fine sandy loam, 1 to 5 percent slopes
34	Pernitas sandy clay loam, 0 to 1 percent slopes
35	Pernitas sandy clay loam, 1 to 5 percent slopes
36	Pernitas sandy clay loam, gullied
37	Pettus sandy clay loam, 0 to 3 percent slopes
38	Pettus sandy clay loam, 3 to 5 percent slopes
39	Pettus sandy clay loam, gullied
40	Pharr fine sandy loam, 0 to 1 percent slopes
41	Pharr fine sandy loam, 1 to 3 percent slopes
42	Pharr sandy clay loam, 0 to 1 percent slopes
43	Pharr sandy clay loam, 1 to 3 percent slopes
44	Pits
45	Racombes sandy clay loam, 0 to 1 percent slopes
46	Runge fine sandy loam, 0 to 1 percent slopes
47	Runge fine sandy loam, 1 to 3 percent slopes
48	Runge fine sandy loam, 3 to 5 percent slopes
49	Runge sandy clay loam, 0 to 1 percent slopes
50	Runge sandy clay loam, 1 to 3 percent slopes
51	Sarita loamy fine sand, 0 to 5 percent slopes
52	Sinton sandy clay loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

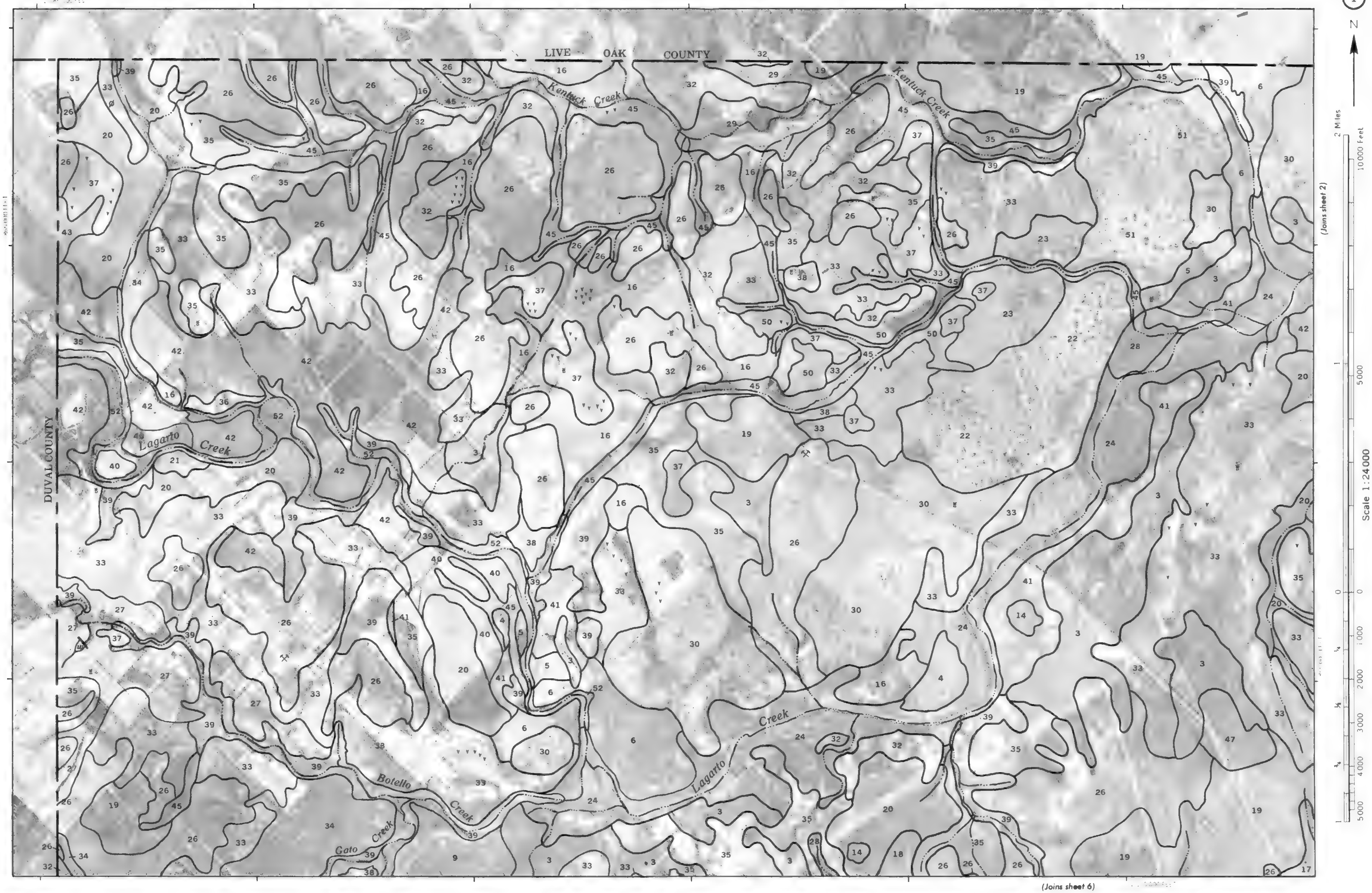
DEPRESSION OR SINK

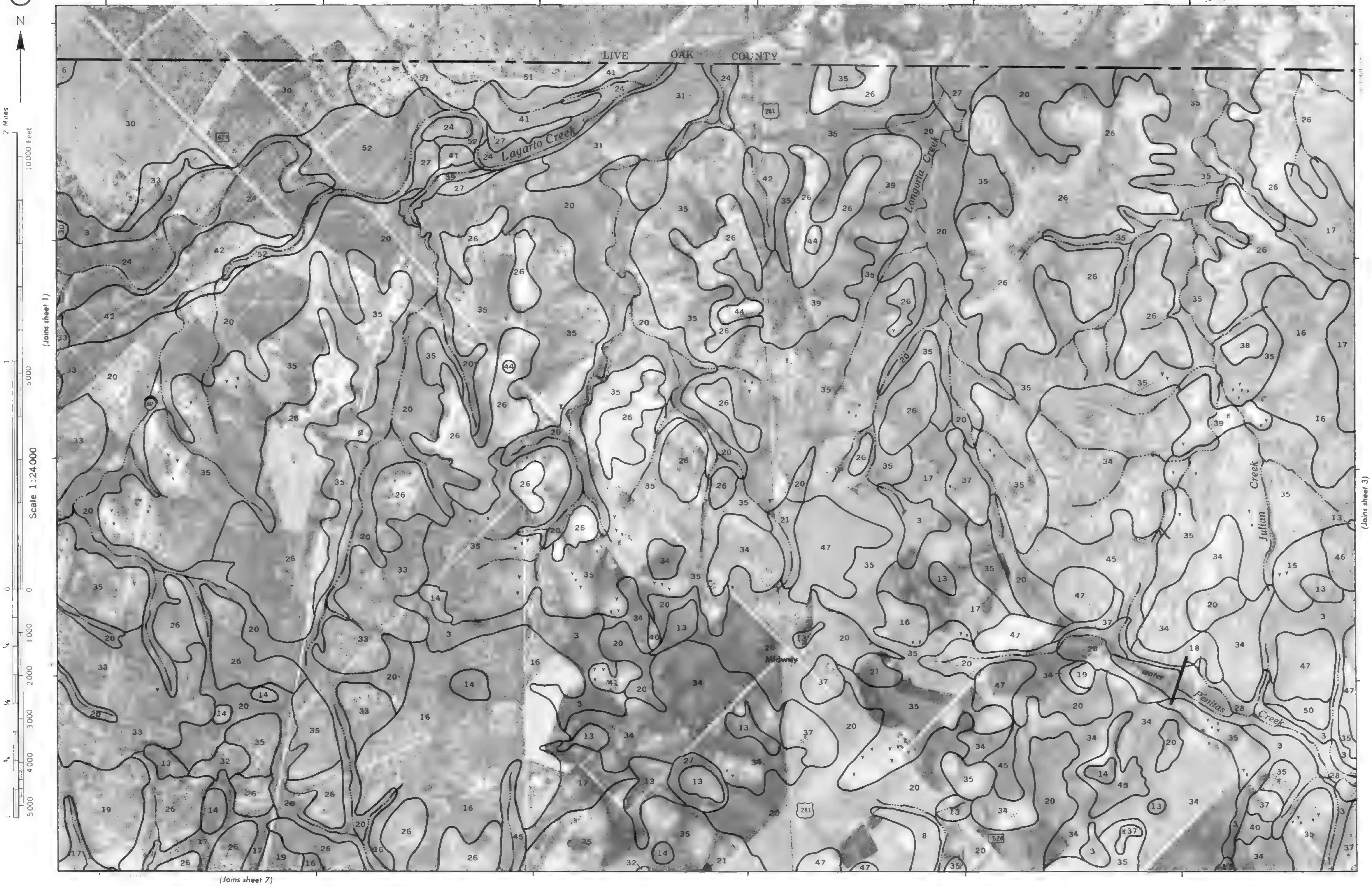
SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

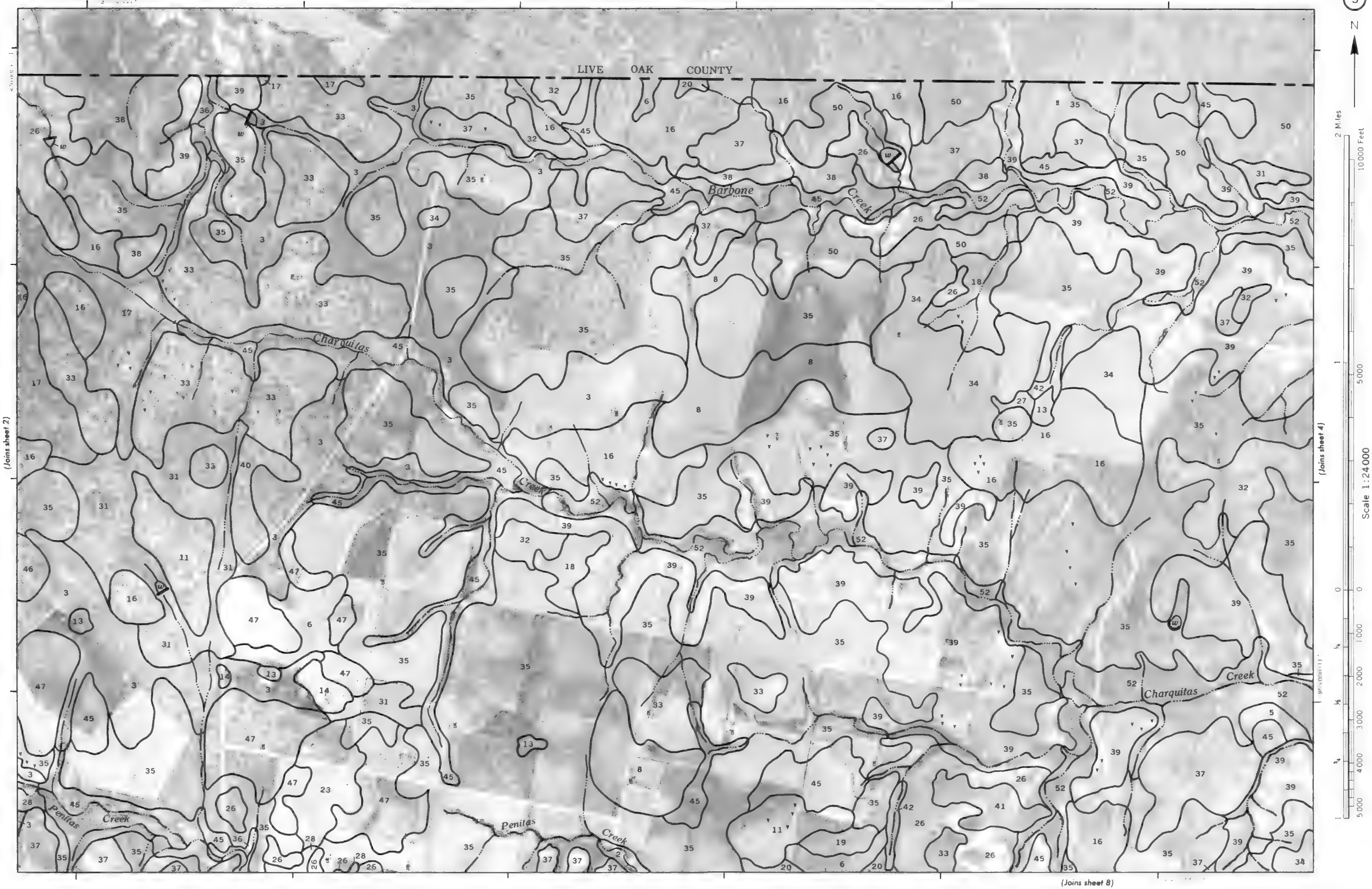
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

JIM WELLS COUNTY, TEXAS — SHEET NUMBER 1



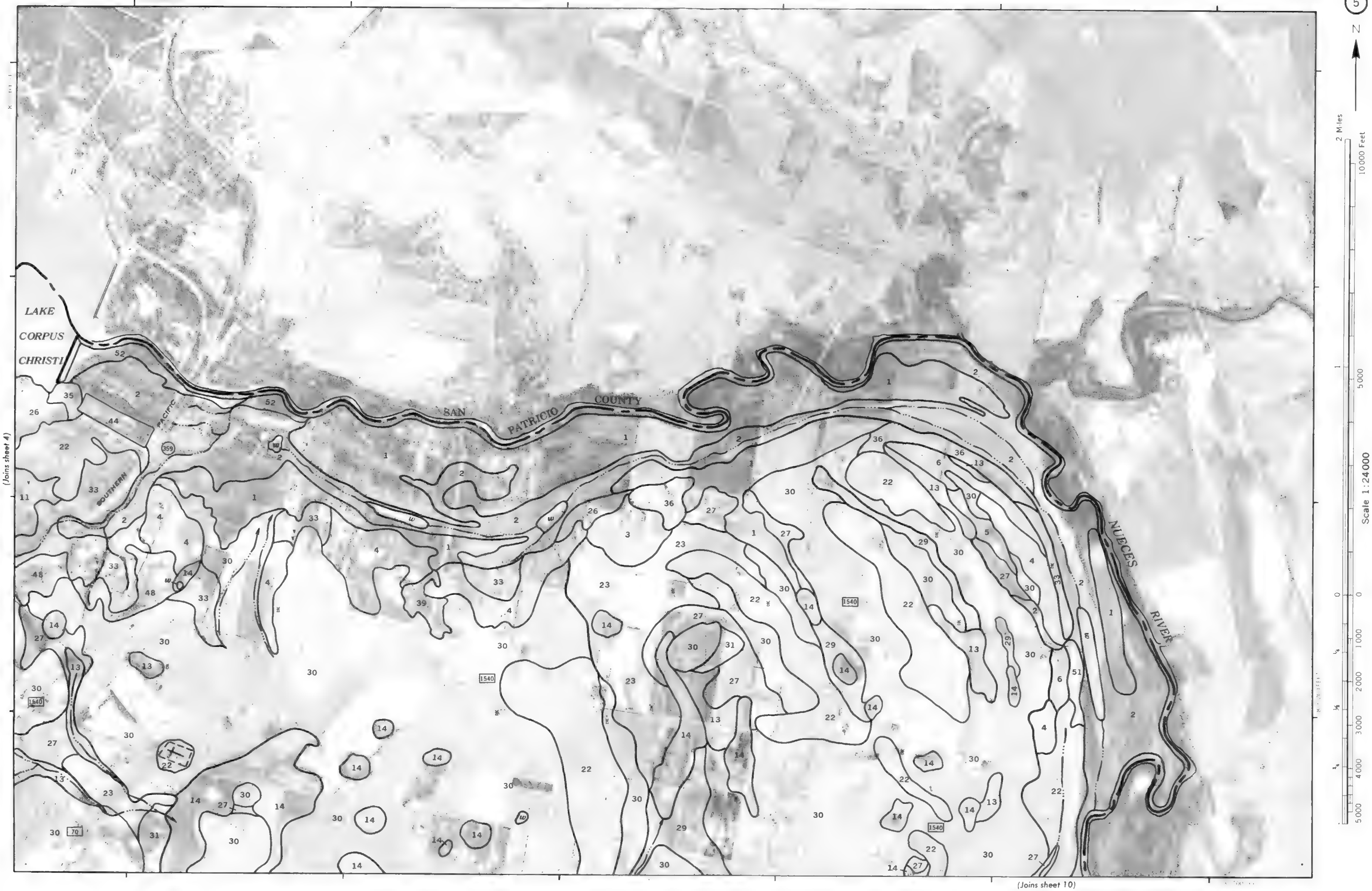

N
2 Miles
10 000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000
LIVE OAK COUNTY
Lagarto Creek
Longoria Creek
Julian Creek
Penitas Creek
Midway
water
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 7)

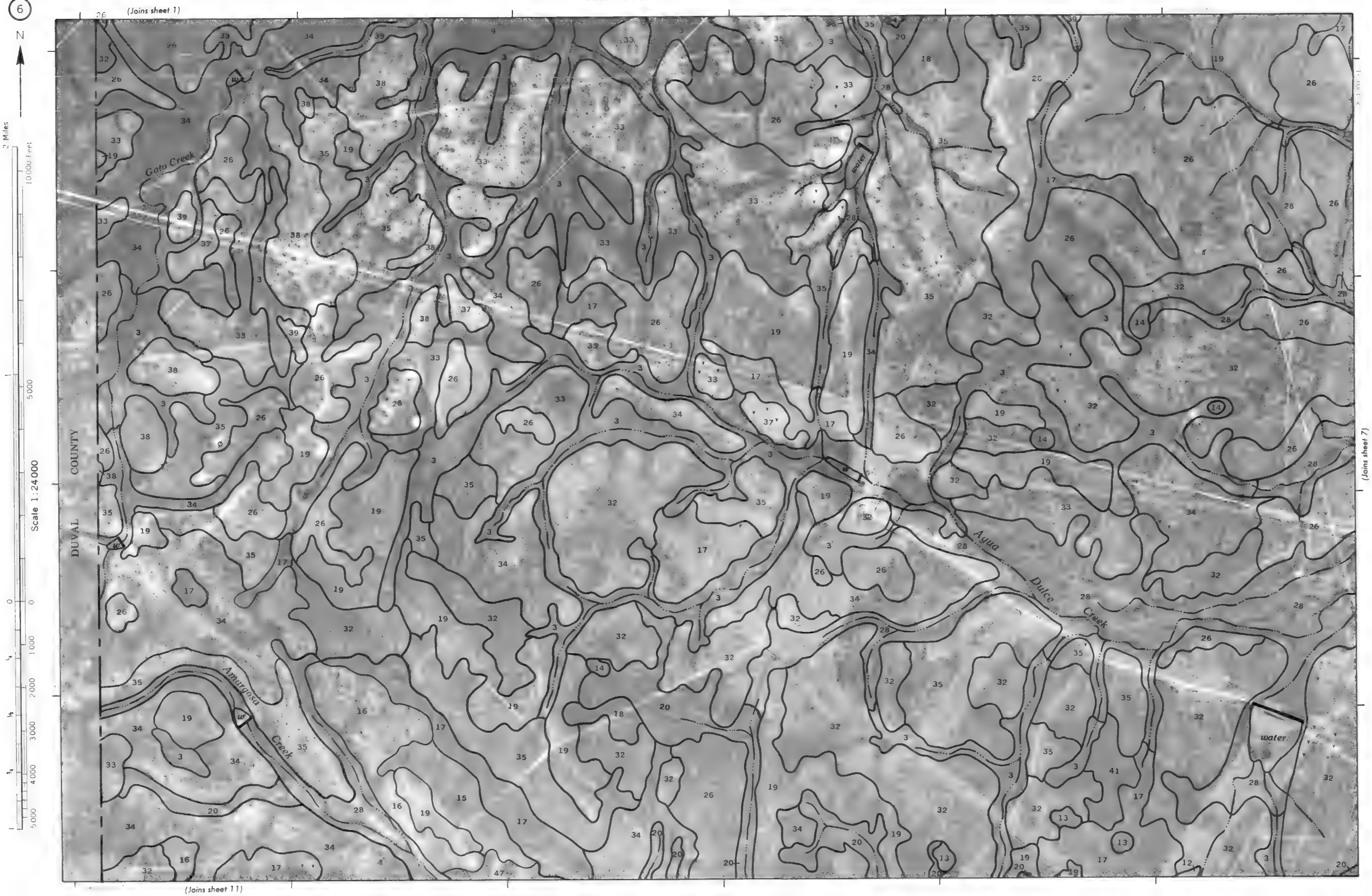
JIM WELLS COUNTY, TEXAS — SHEET NUMBER 3

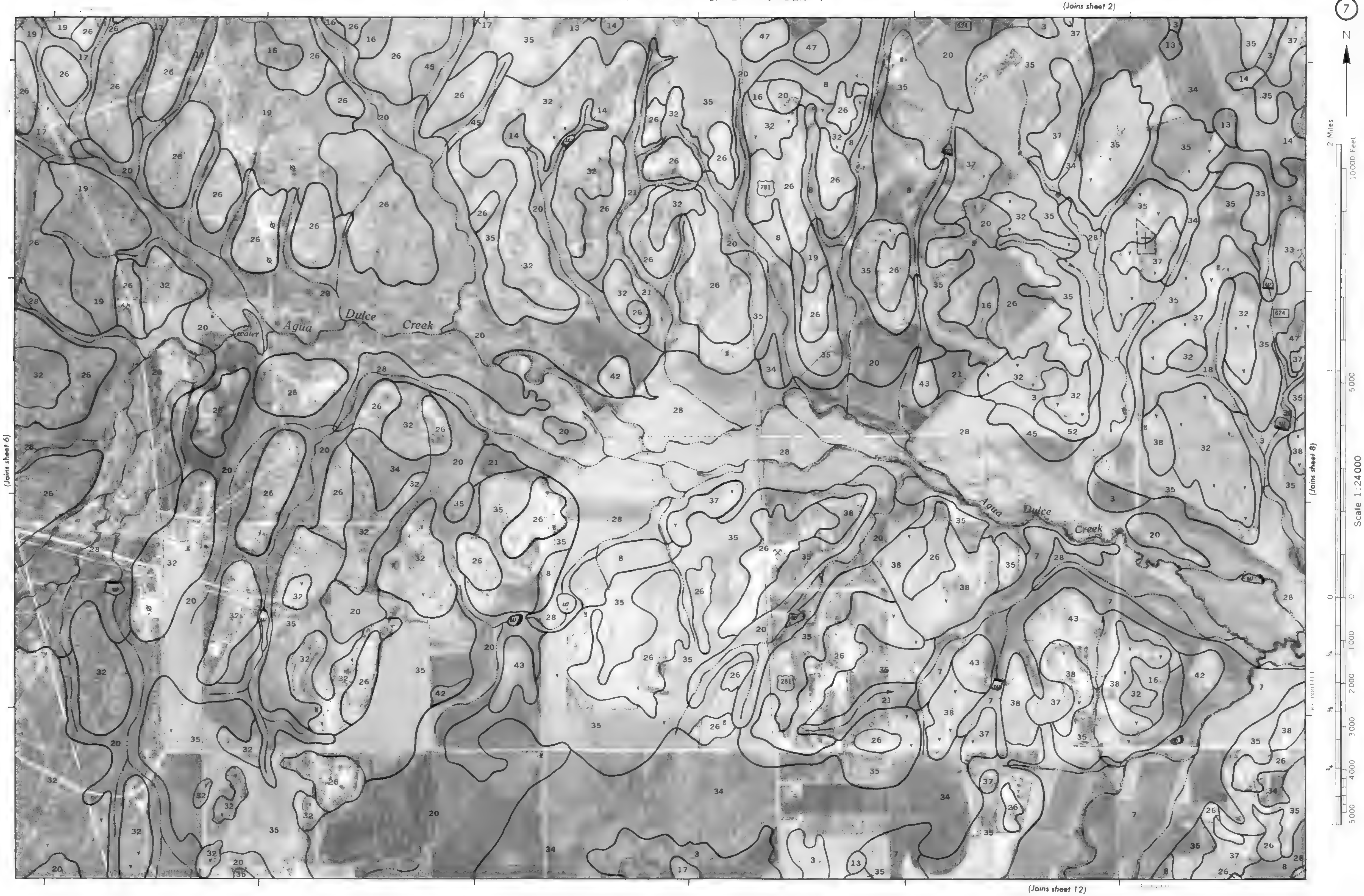


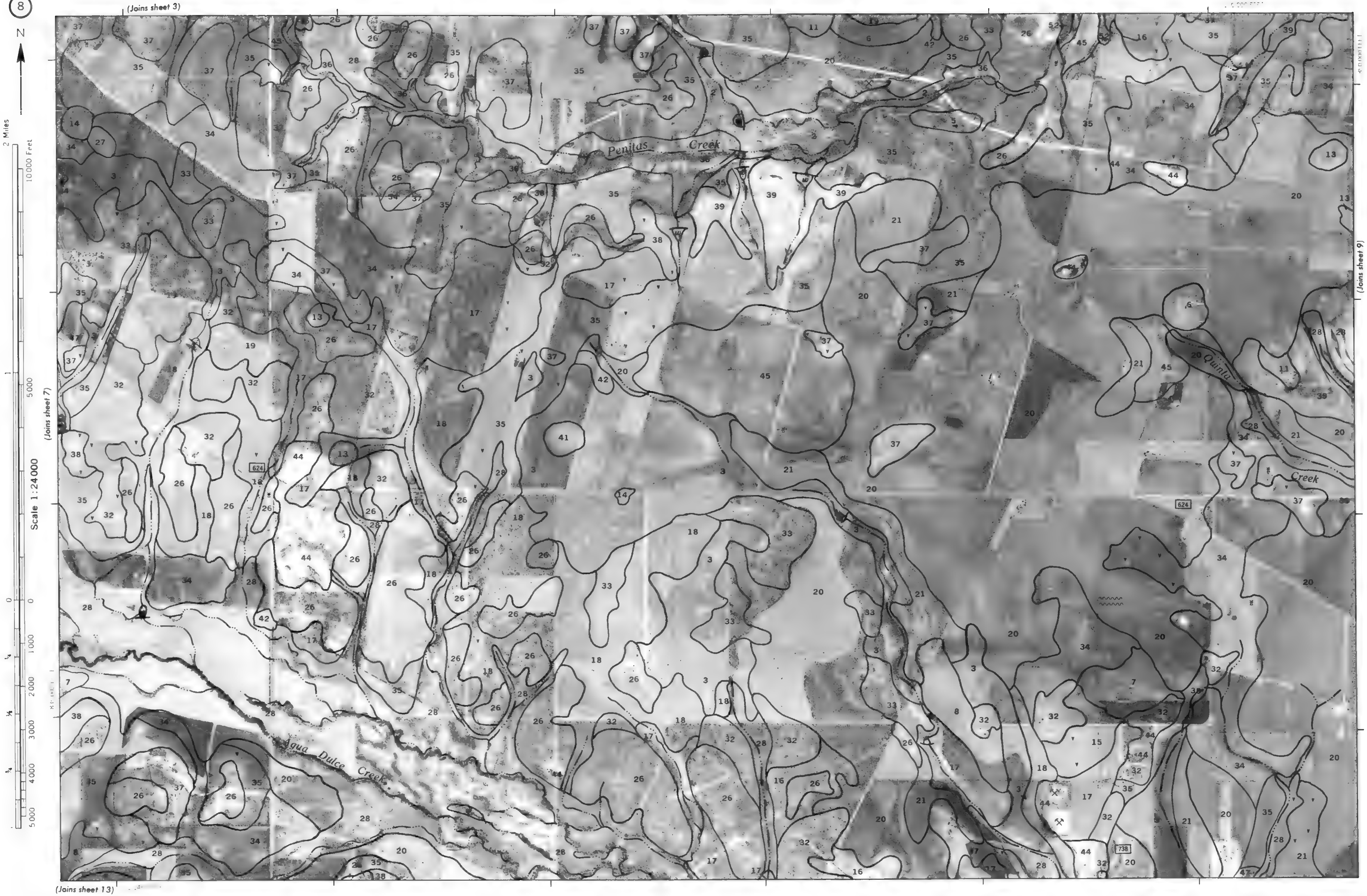
4

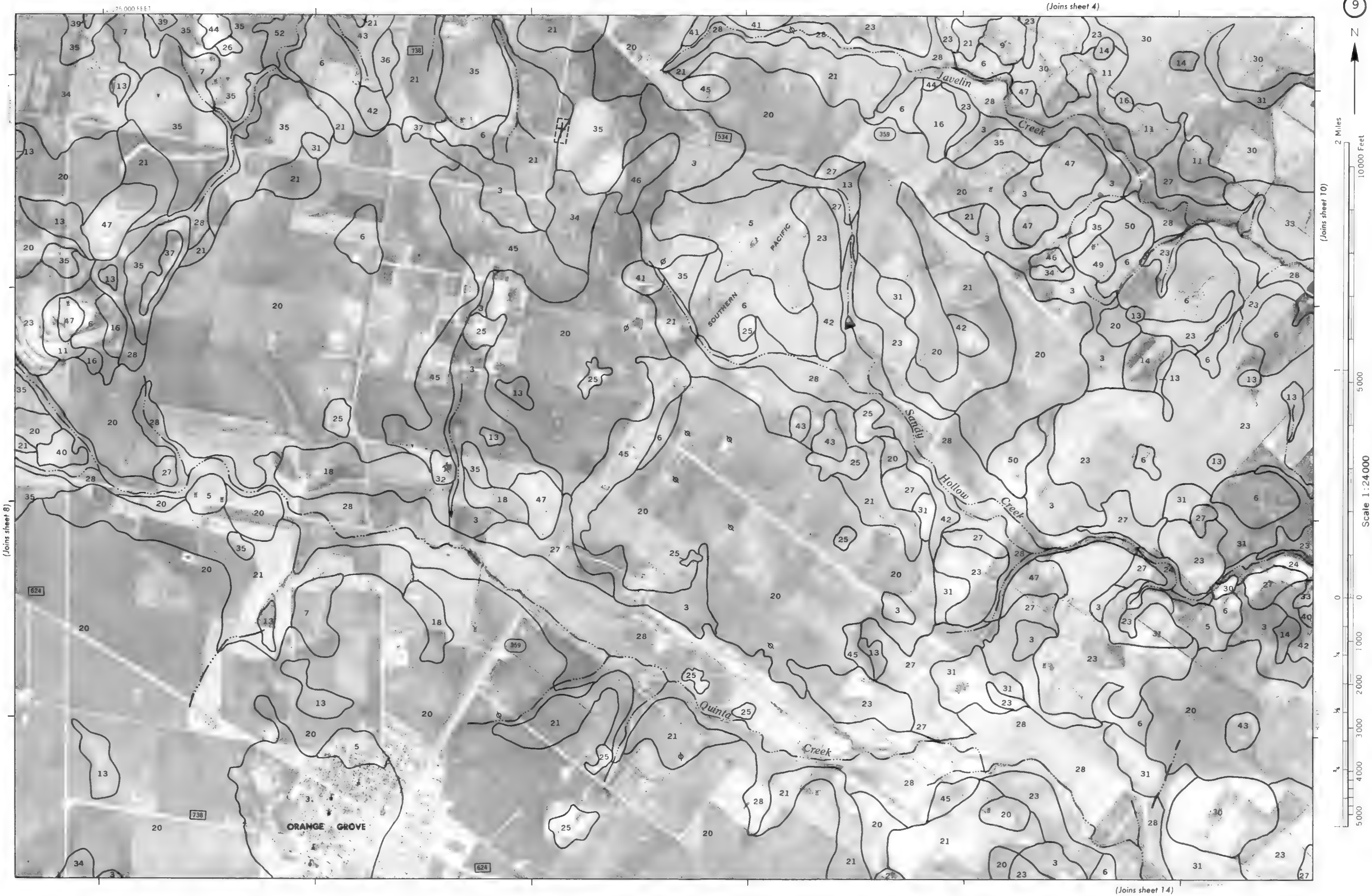

N
2 Miles
10000 Feet
Scale 1:24000
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 9)
LIVE OAK COUNTY
SAN PATRICIO COUNTY
LAKE CORPUS CHRISTI
Barbone Creek
Penitas Creek
Hobbs Hollow
Sandia
SOUTHERN PACIFIC
534
738
1540
359
70

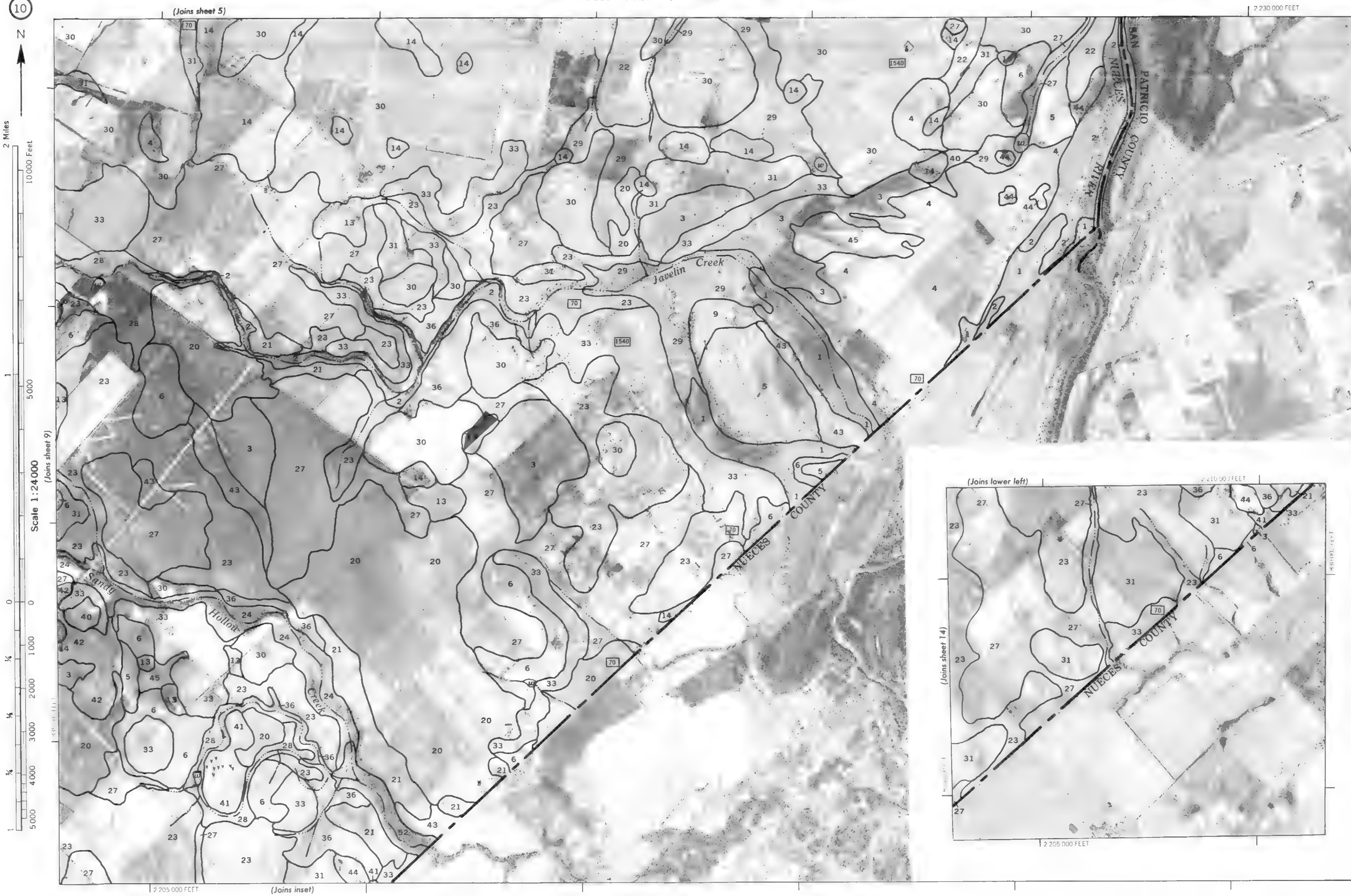

5
N
LAKE
CORPUS
CHRISTI
SAN PATRICIO COUNTY
SOUTHERN PACIFIC
NUECES RIVER
(Joins sheet 4)
(Joins sheet 10)
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000

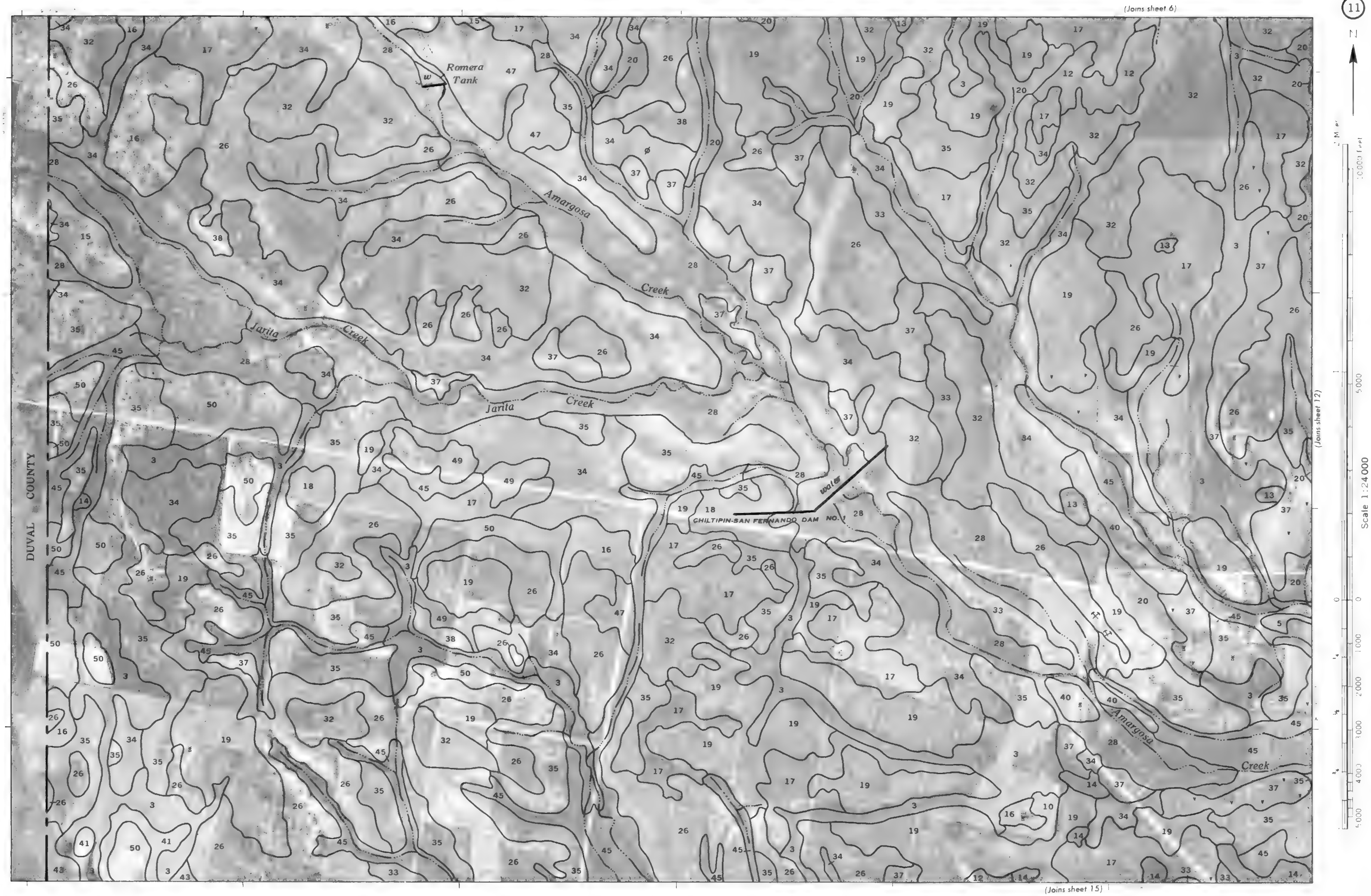

(Joins sheet 1)
N
2 Miles
10000 Feet
5000
0
Scale 1:24 000
DUVAL COUNTY
Gato Creek
Agua Dulce Creek
Amargosa Creek
water
(Joins sheet 7)
(Joins sheet 11)


(Joins sheet 2)
(Joins sheet 6)
(Joins sheet 8)
(Joins sheet 12)
Agua Dulce Creek
Agua Dulce Creek
water
N
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000


8
(Joins sheet 3)
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 13)
N
2 Miles
10 000 Feet
5000
Scale 1:24 000
Penitas Creek
Quinta Creek
Agua Dulce Creek
624
738

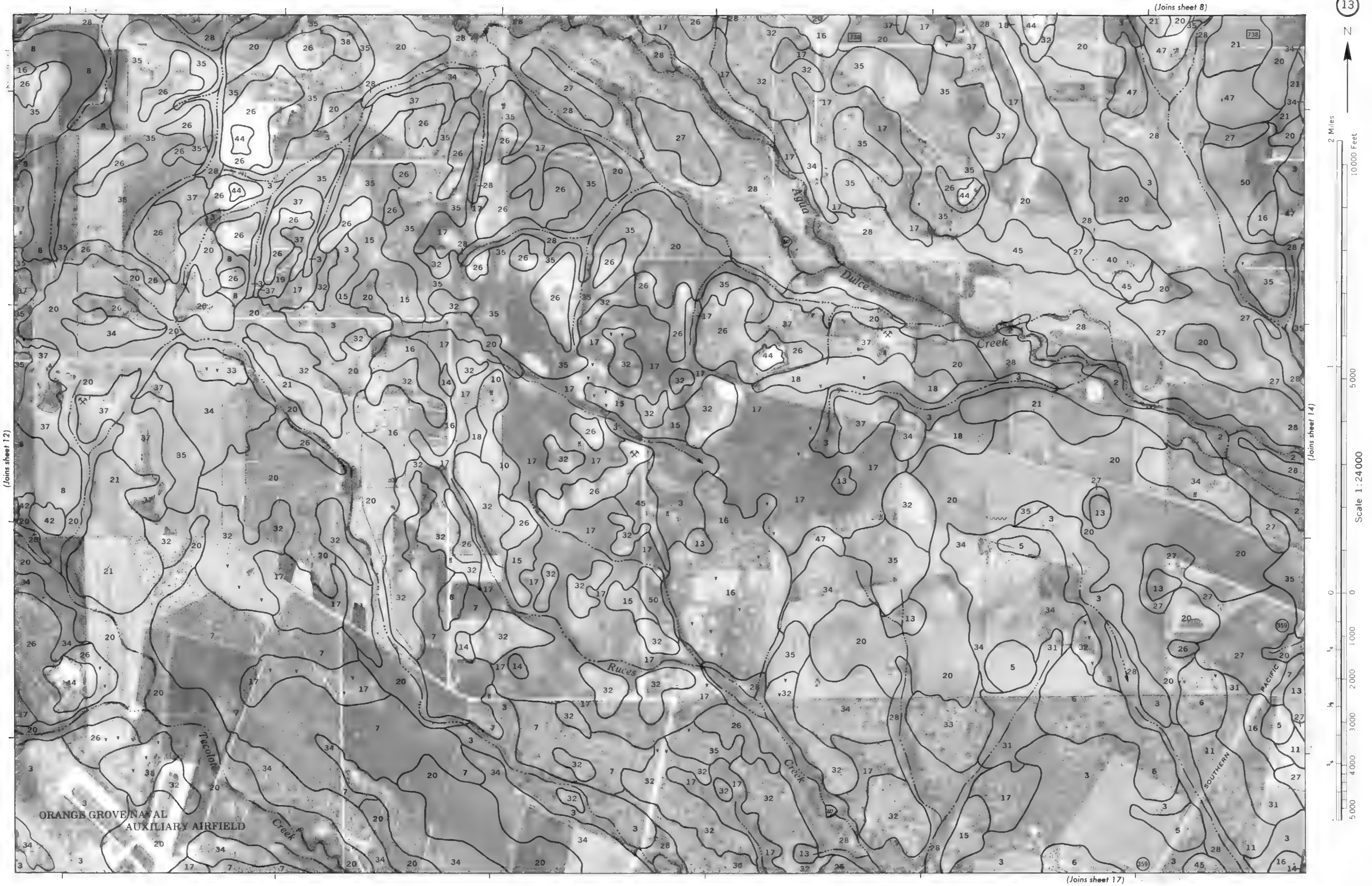

9
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 14)
Javelin Creek
Sandy Hollow Creek
Quinta Creek
SOUTHERN PACIFIC
ORANGE GROVE
738
534
359
624
N
2 Miles
10000 Feet
5000
1000
2000
3000
4000
5000
0
Scale 1:24000


10
N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 5)
(Joins sheet 9)
(Joins inset)
2 230 000 FEET
2 205 000 FEET
Javelin Creek
Sandy Hollow Creek
NUECES COUNTY
SAN PATRICIO COUNTY
NUECES RIVER
(Joins lower left)
(Joins sheet 14)

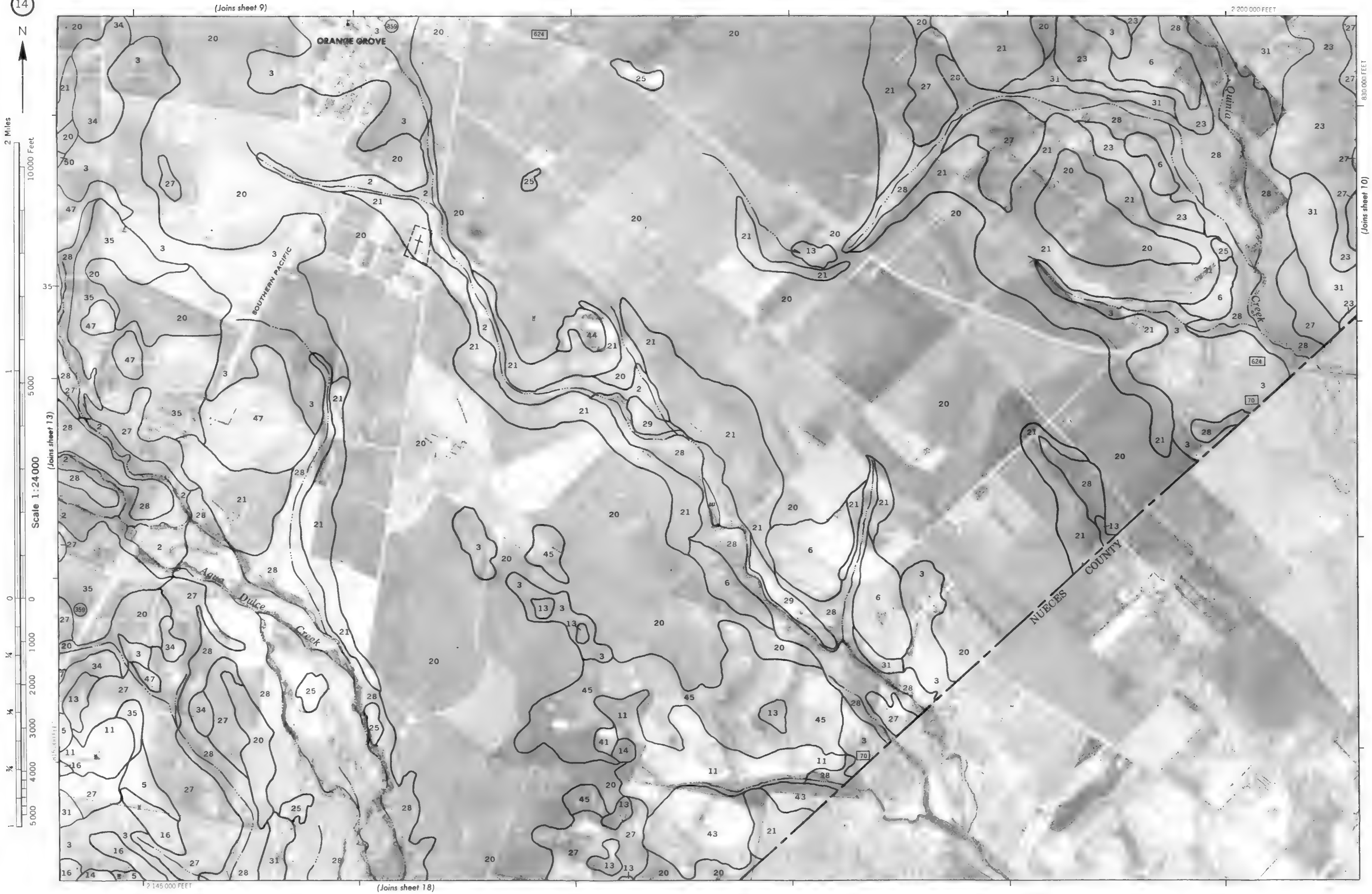

11
N
(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 15)
DUVAL COUNTY
Romera Tank
Amargosa Creek
Jarita Creek
Jarita Creek
CHILTIPIN-SAN FERNANDO DAM NO. 1
water
Amargosa Creek
Scale 1:24 000
1 Mile
10000 Feet
5000
0

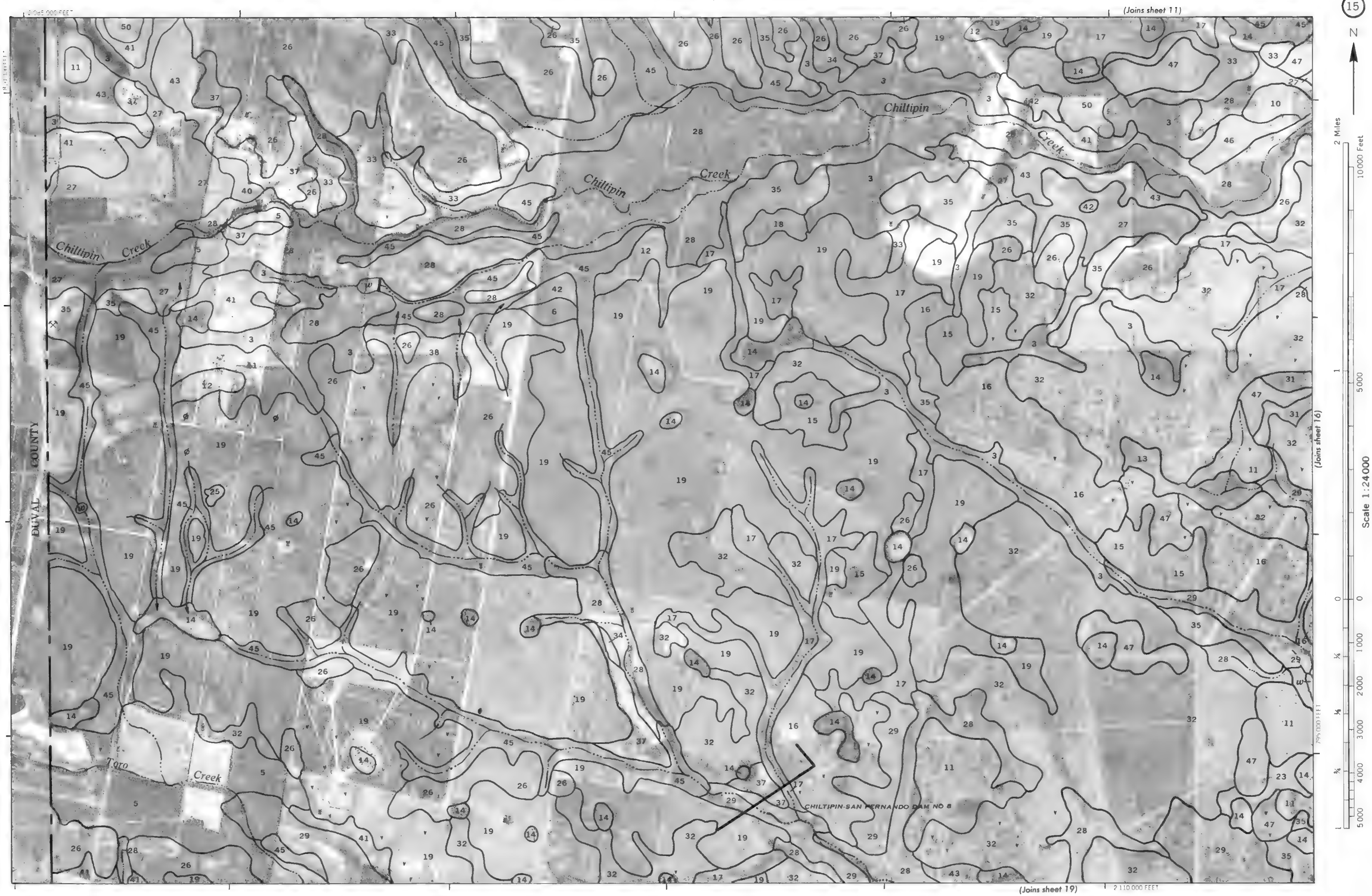

12
N
(Joins sheet 7)
(Joins sheet 16)
(Joins sheet 11)
(Joins sheet 13)
2 Miles
10000 Feet
Scale 1:24000
El Caro Creek
Tecolote Creek
Javalina Creek
Amargosa Creek
ORANGE GROVE NAVAL AUXILIARY AIRFIELD
water
281

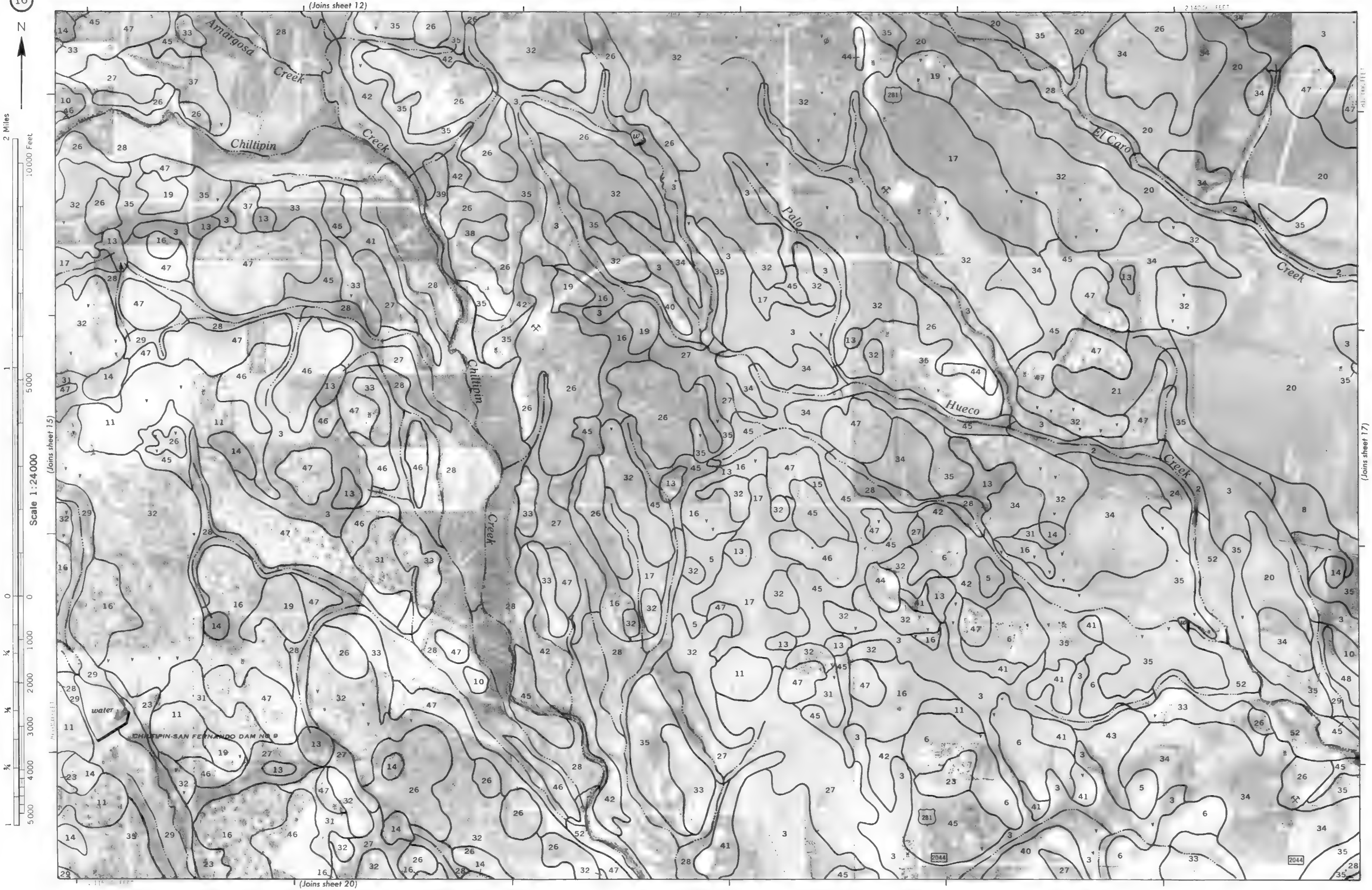
JIM WELLS COUNTY, TEXAS — SHEET NUMBER 13

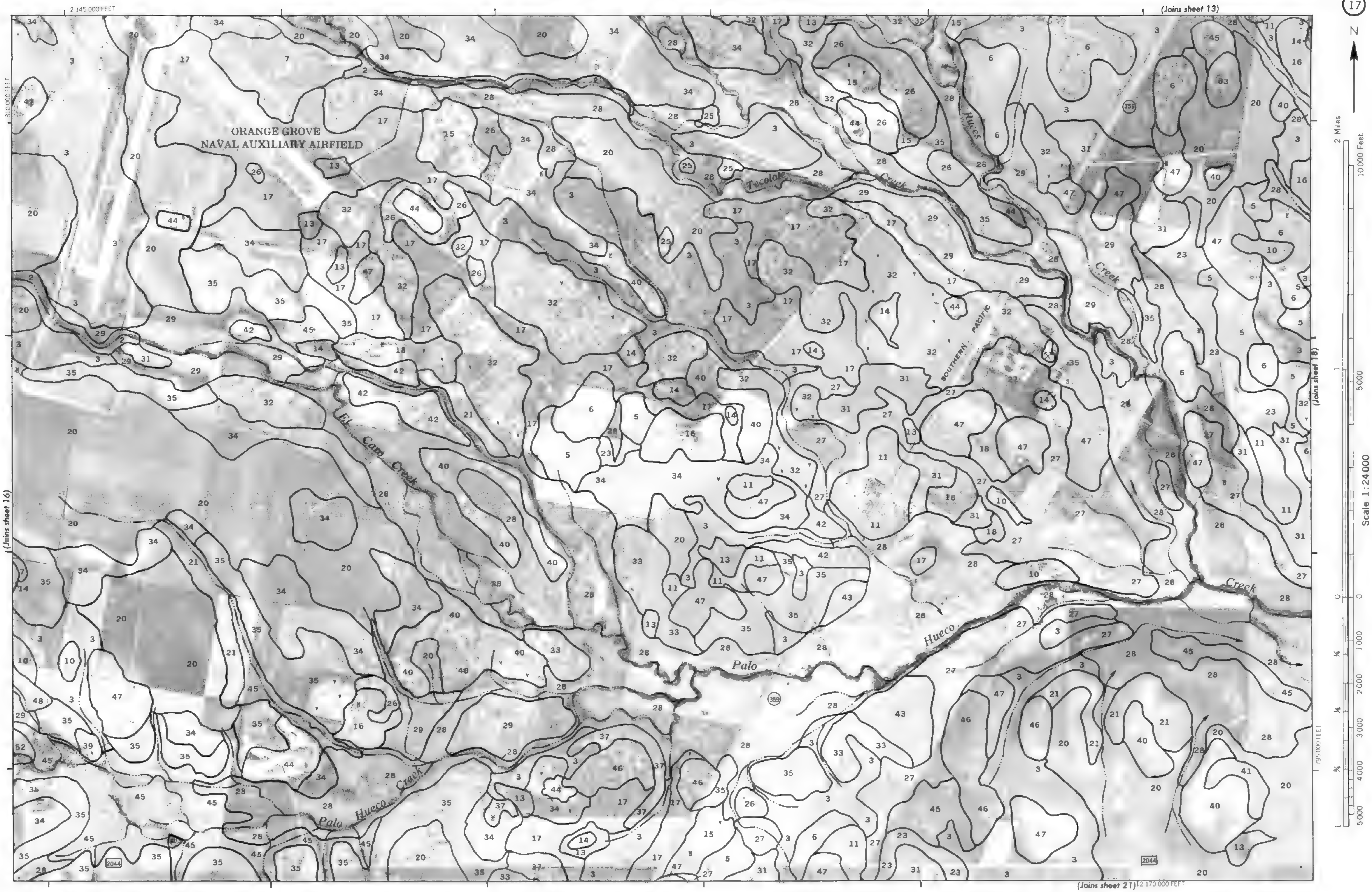


JIM WELLS COUNTY, TEXAS — SHEET NUMBER 14

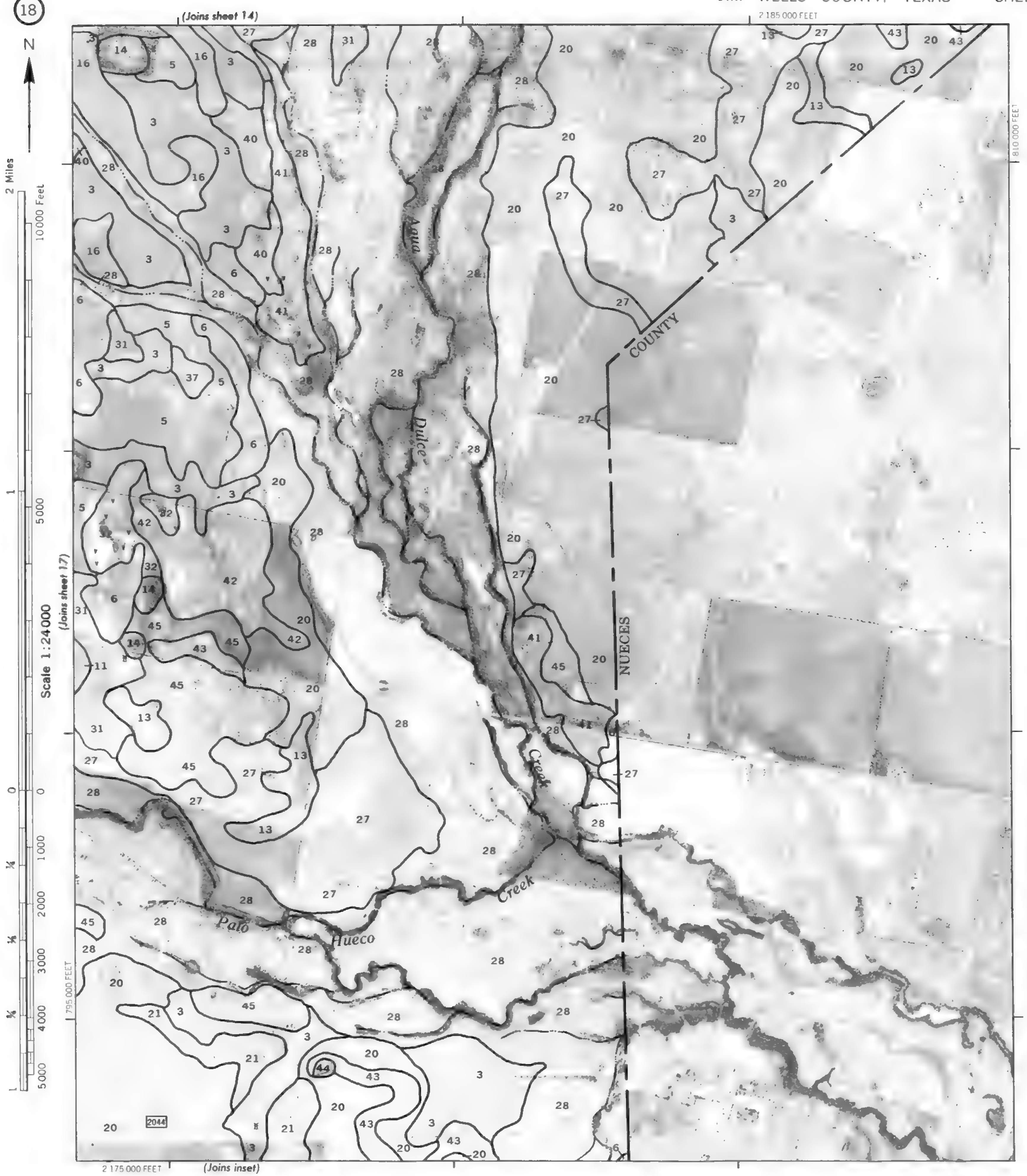


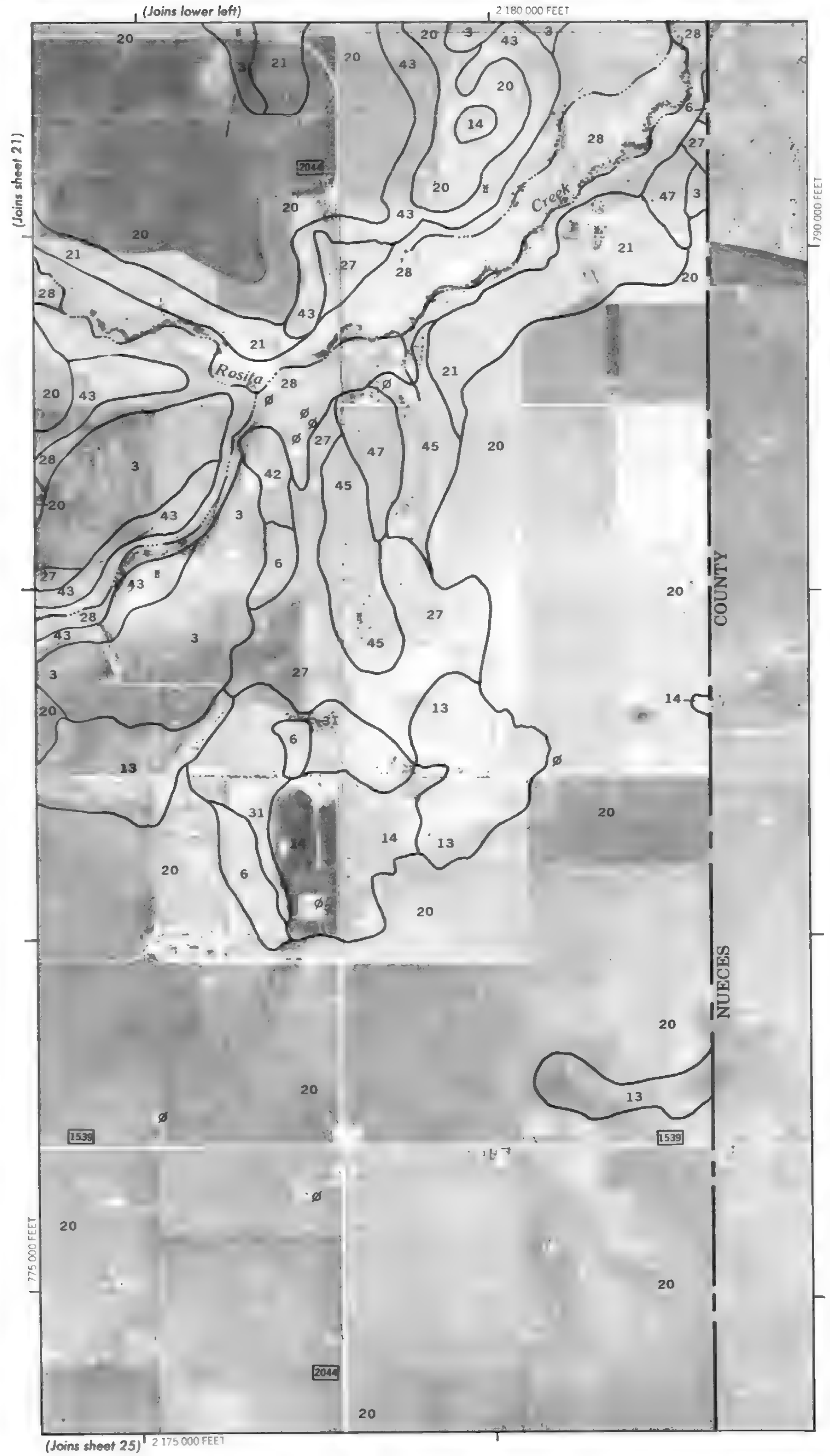

15
N
(Joins sheet 11)
(Joins sheet 16)
(Joins sheet 19)
Chiltipin Creek
Chiltipin Creek
Chiltipin Creek
Chiltipin Creek
Toro Creek
DUVAL COUNTY
CHILTIPIN-SAN FERNANDO DAM NO 8
2 110 000 FEET
Scale 1:24000
2 Miles
10 000 Feet
5000
0
1000
2000
3000
4000
5000


(Joins sheet 12)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 20)
N
2 Miles
10000 Feet
Scale 1:24000
Amargosa Creek
Chiltipin Creek
Chiltipin Creek
Palo Hueco Creek
El Caro Creek
water
CHILTIPIN-SAN FERNANDO DAM NO 9

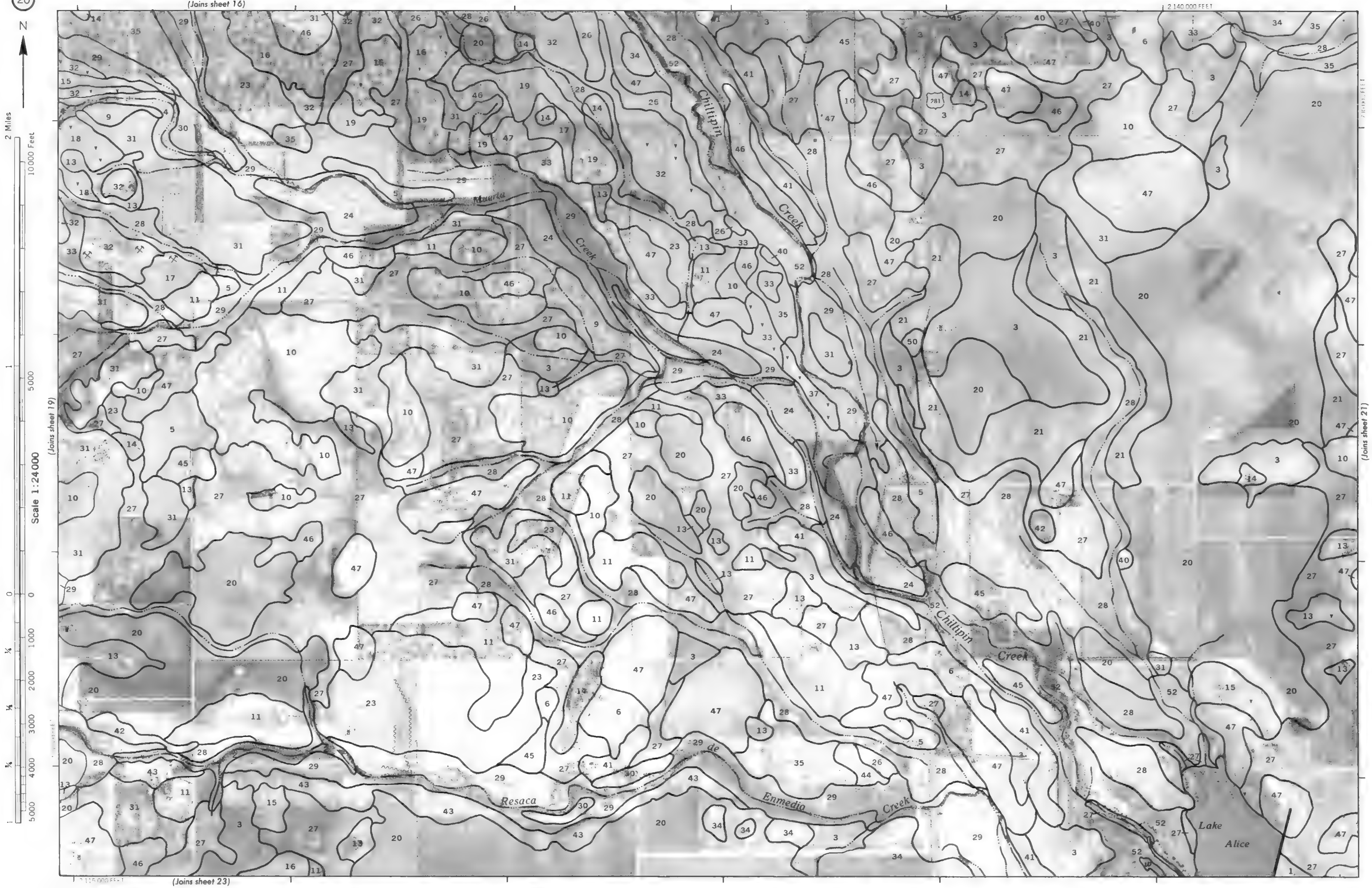

17
N
(Joins sheet 13)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 21)
2 145 000 FEET
810 000 FEET
795 000 FEET
2 170 000 FEET
ORANGE GROVE
NAVAL AUXILIARY AIRFIELD
Tecolote Creek
Rucias
Creek
El Cami Creek
Palo Hueco Creek
Palo Hueco
Creek
SOUTHERN PACIFIC
359
2044
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000

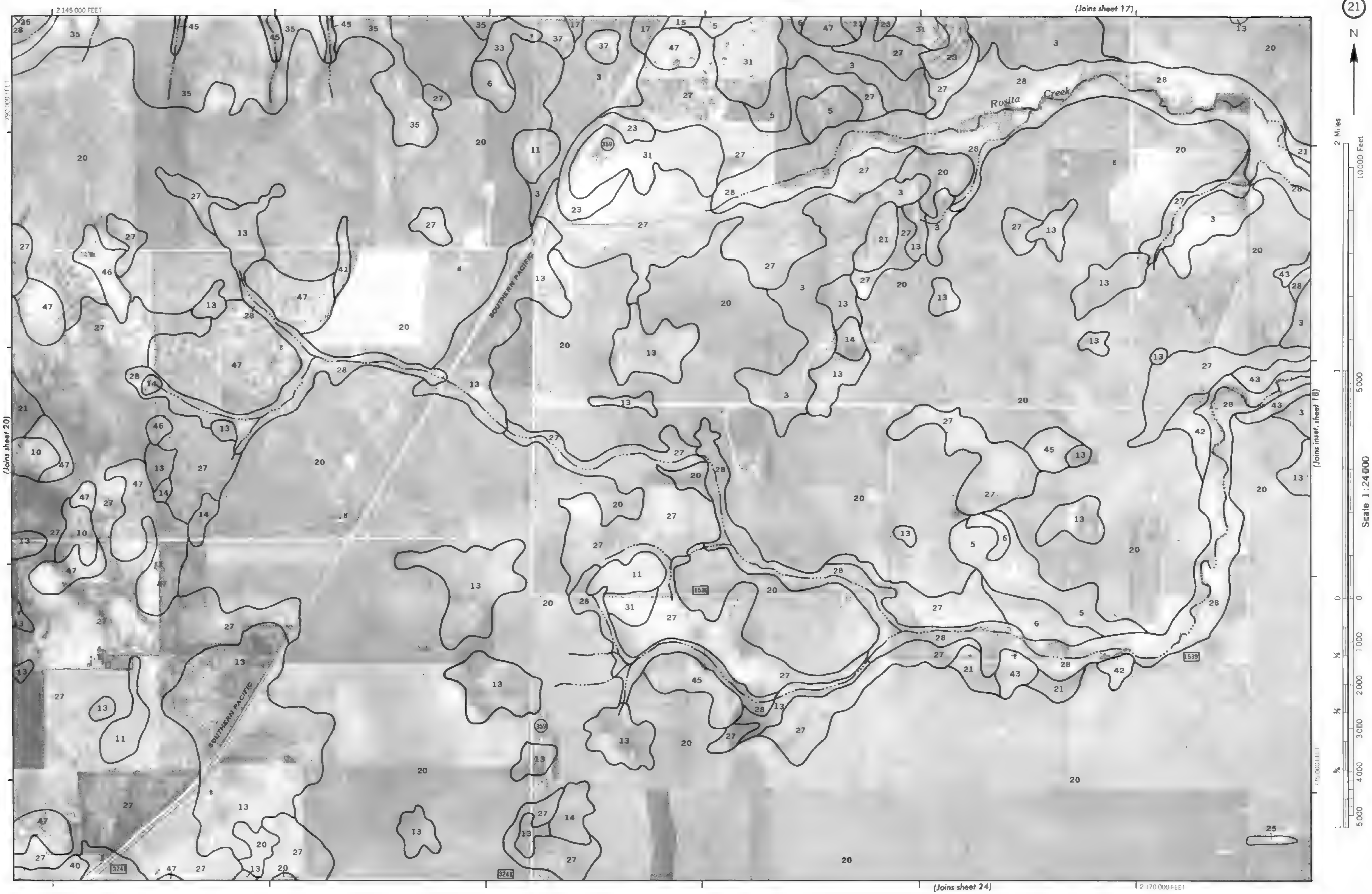
JIM WELLS COUNTY, TEXAS — SHEET NUMBER 18

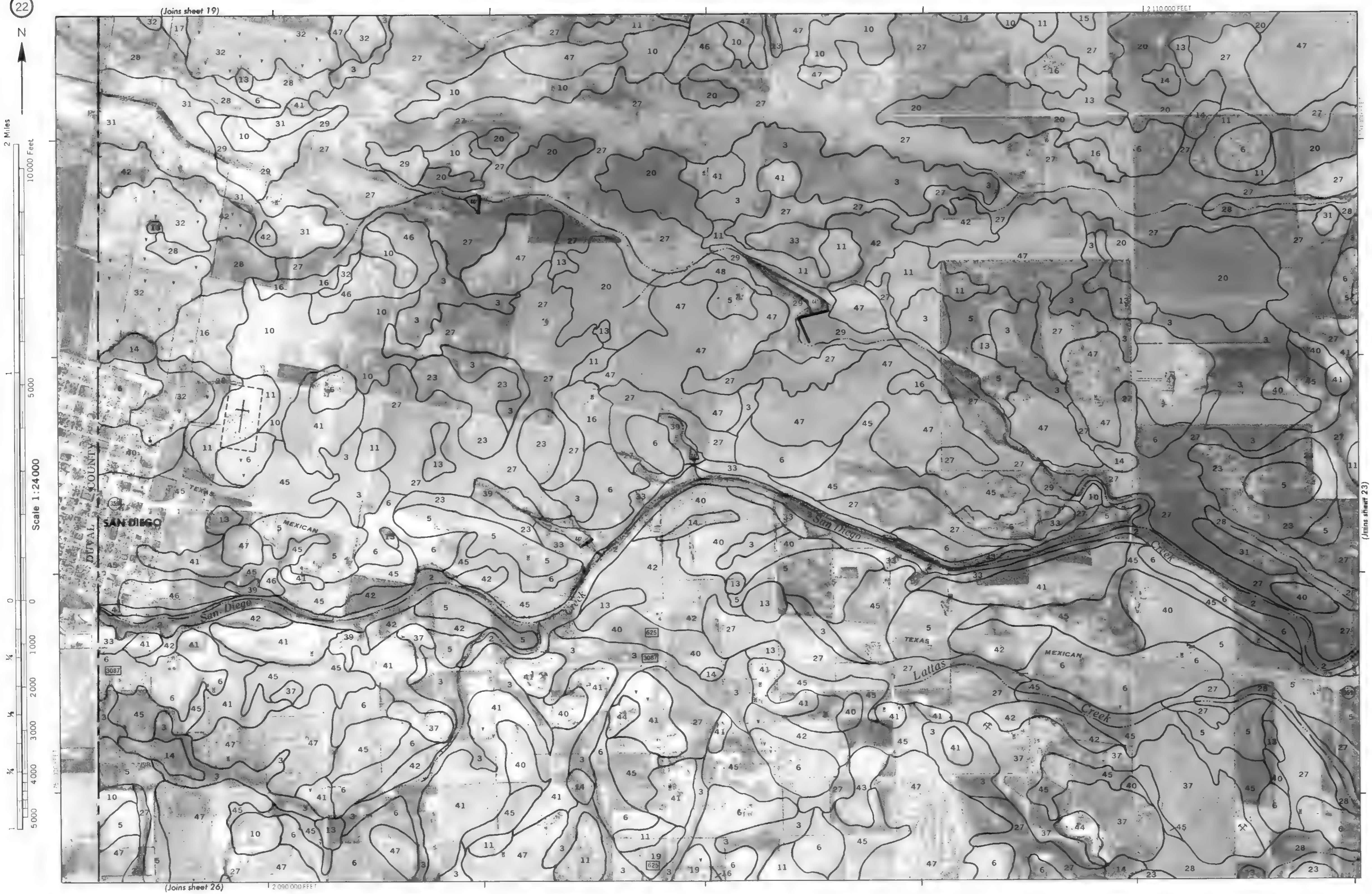




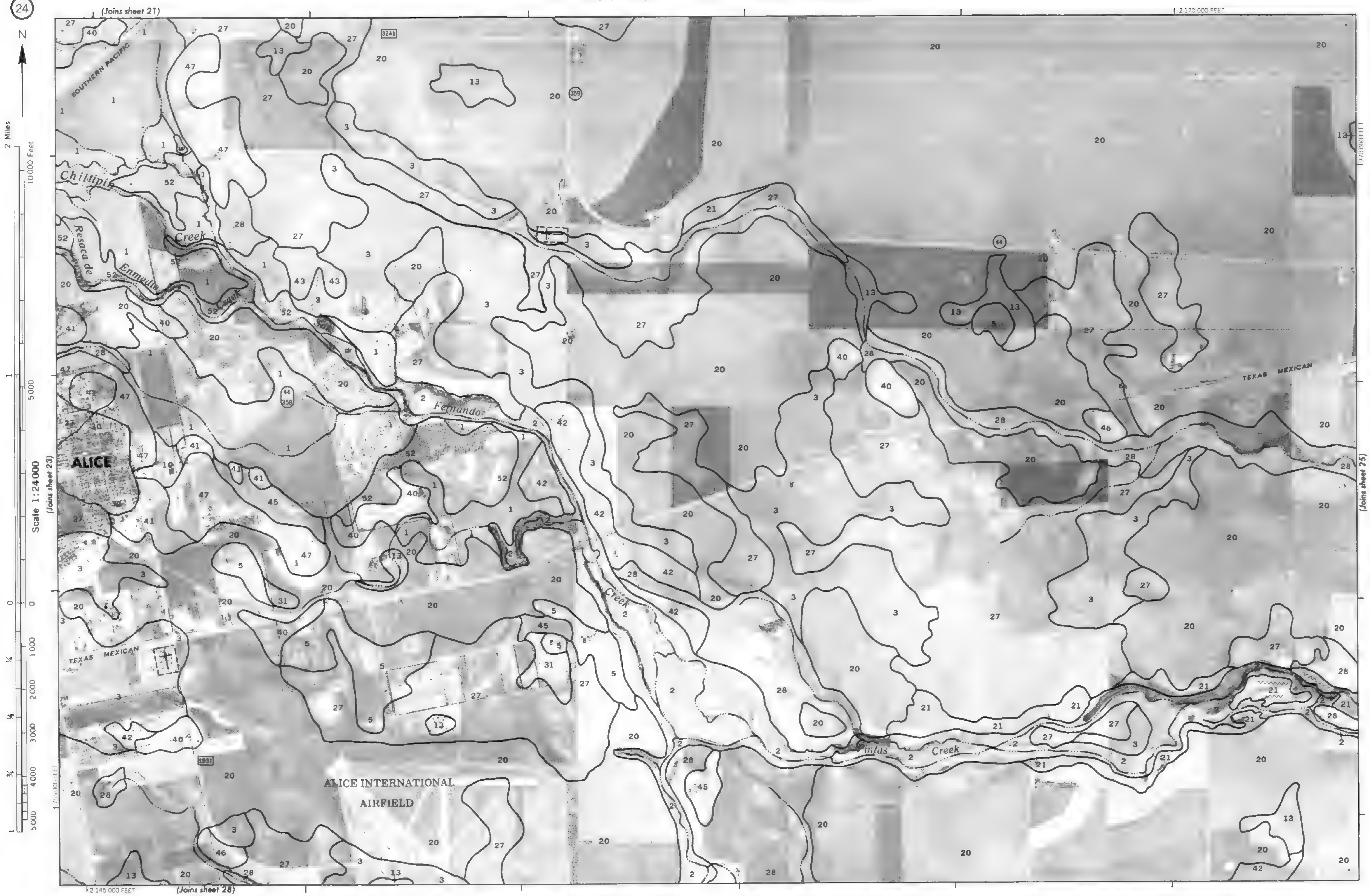

(Joins sheet 15)
(Joins sheet 20)
(Joins sheet 22)
DUVAL COUNTY
Muerto Creek
Toro Creek
Muerto Creek
Muerto Creek
CHILTIPIN-SAN FERNANDO DAM NO 6
Resaca de Enmedio
Resaca de Enmedio
N
2 Miles
10 000 Feet
Scale 1:24000
2 085 000 FEET

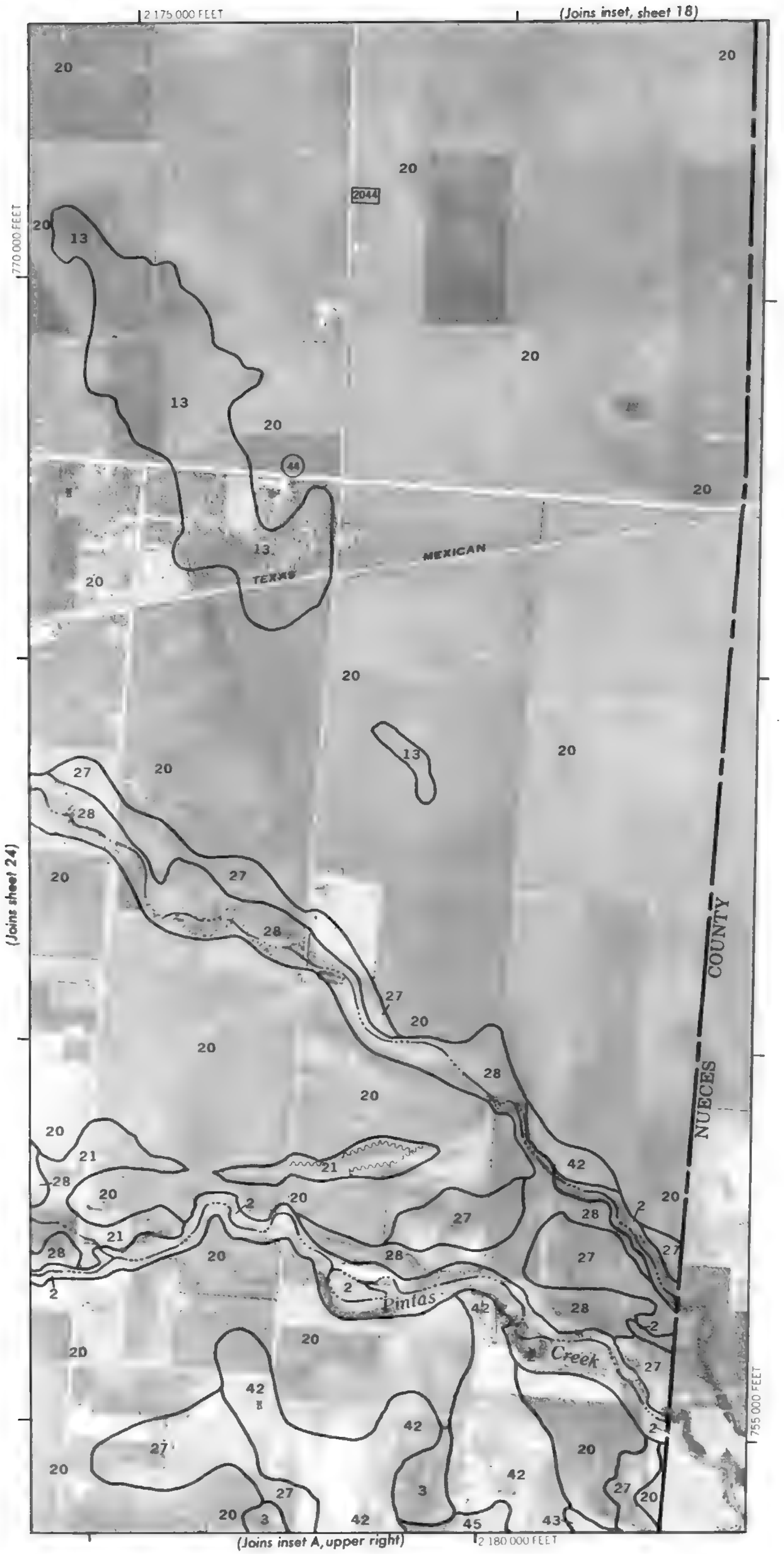

N
(Joins sheet 16)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 23)
2 140 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet
Chiltipin Creek
Mauria Creek
Resaca de Enmedio Creek
Lake Alice


21
N
(Joins sheet 17)
(Joins sheet 20)
(Joins inset, sheet 18)
(Joins sheet 24)
2 145 000 FEET
2 170 000 FEET
795 000 FEET
775 000 FEET
Rosita Creek
SOUTHERN PACIFIC
359
1539
3241
2 Miles
1
0
10000 Feet
5000
1000
2000
3000
4000
Scale 1:24000

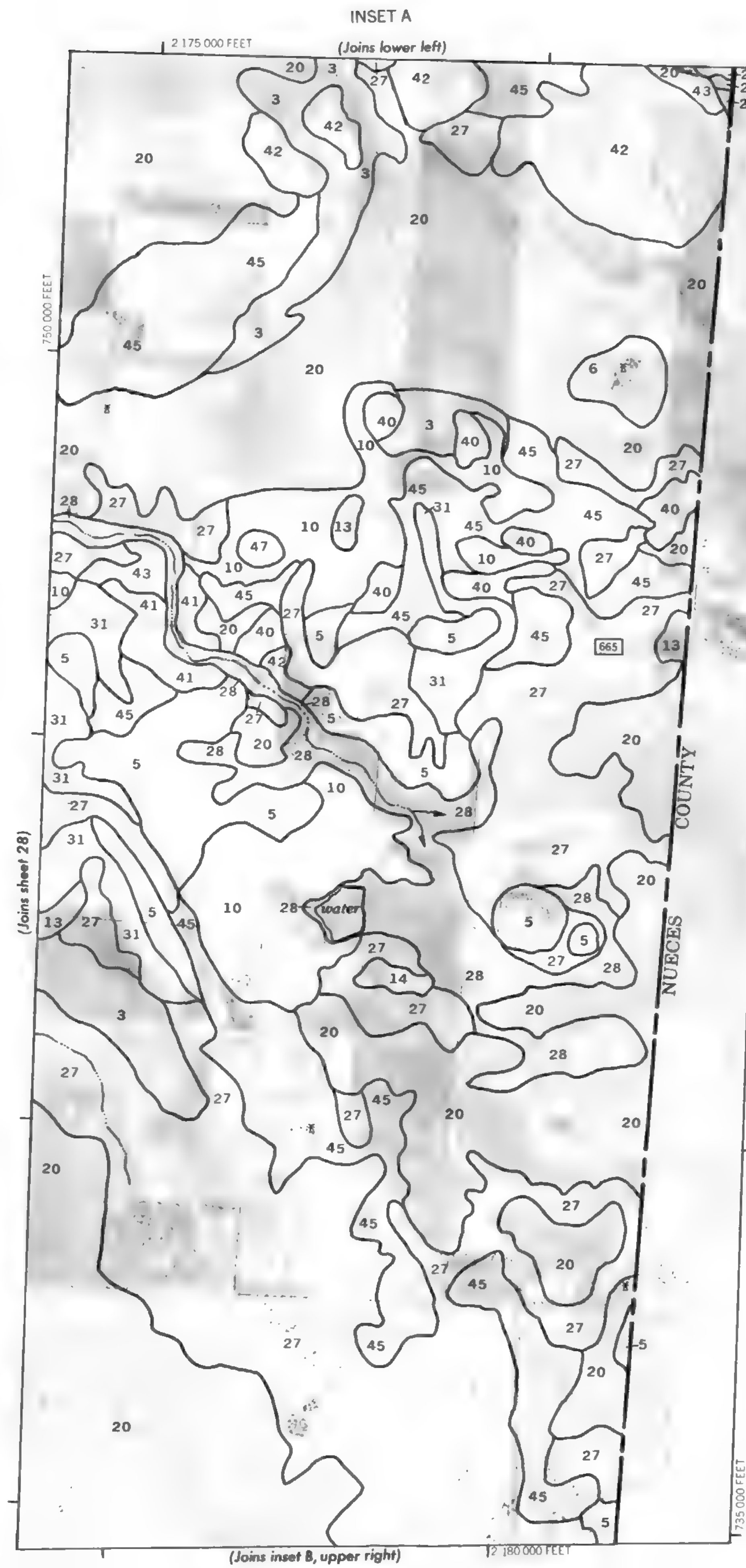

22
N
(Joins sheet 19)
(Joins sheet 26)
(Joins sheet 23)
2 110 000 FEET
2 090 000 FEET
Scale 1:24 000
2 Miles
10 000 Feet
DUVAL COUNTY
SAN DIEGO
TEXAS MEXICAN
San Diego Creek
Lattas Creek
TEXAS MEXICAN


23
N
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 27)
2 115 000 FEET
2 140 000 FEET
Lake Alice
Chiltipin Creek
Resaca de
San Diego Creek
Muerta
Ensenadio Creek
Lattas Creek
ALICE
(county seat)
SOUTHERN PACIFIC
TEXAS MEXICAN
Scale 1:24000
2 Miles
10 000 Feet
1
5000
0
1000
2000
3000
4000
5000

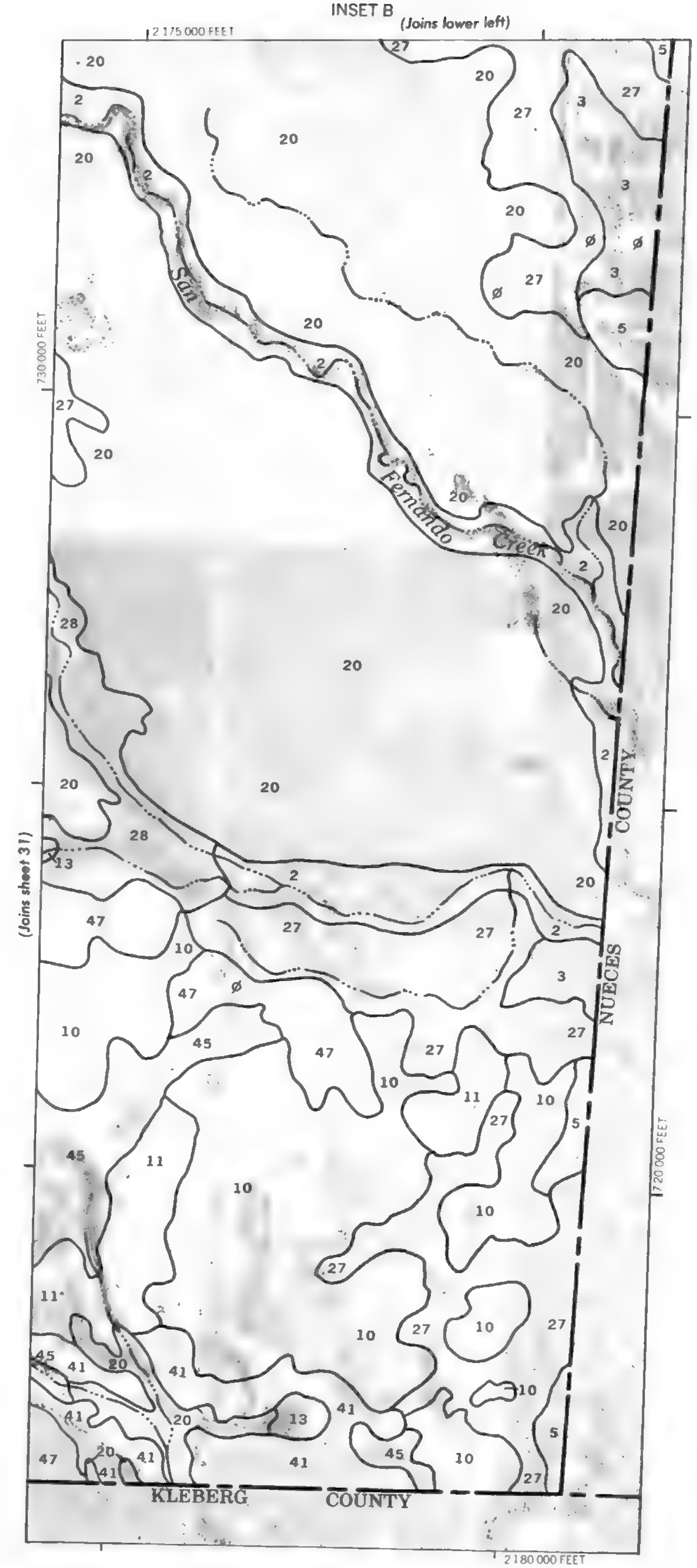

24
N
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 28)
2 170 000 FEET
2 145 000 FEET
Scale 1:24000
2 Miles
10 000 Feet
SOUTHERN PACIFIC
TEXAS MEXICAN
Chiltipin Creek
Resaca de Enmedio Creek
San Fernando Creek
Pintas Creek
ALICE
ALICE INTERNATIONAL AIRFIELD

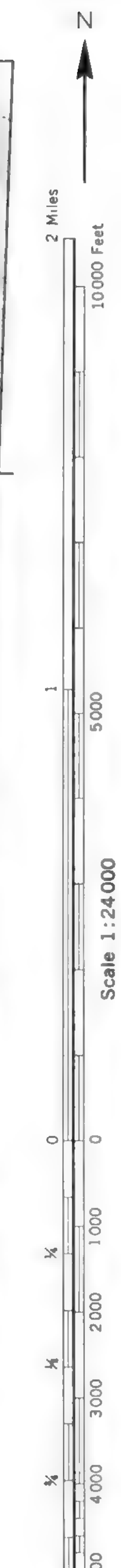


INSET A

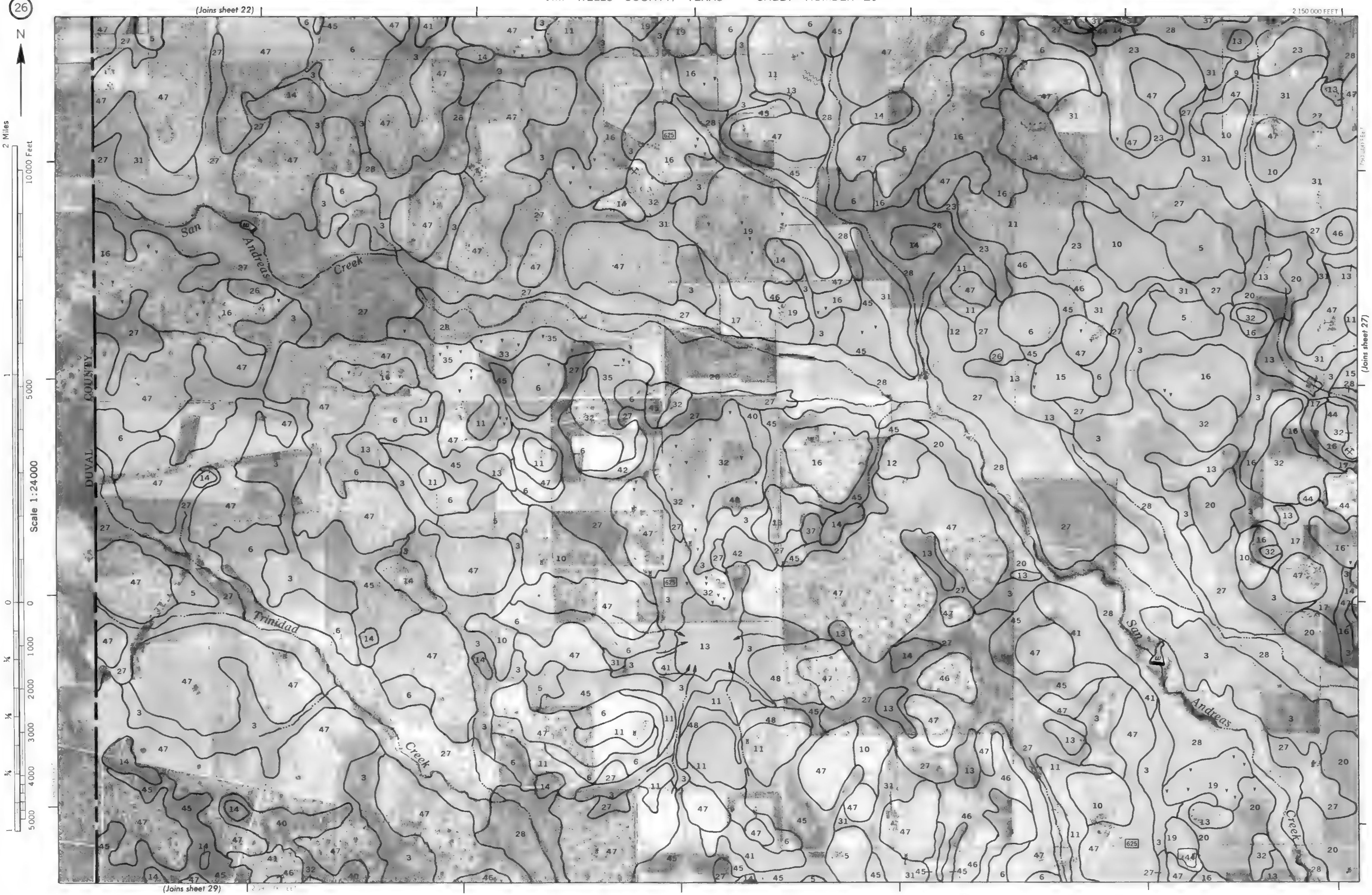


INSET B

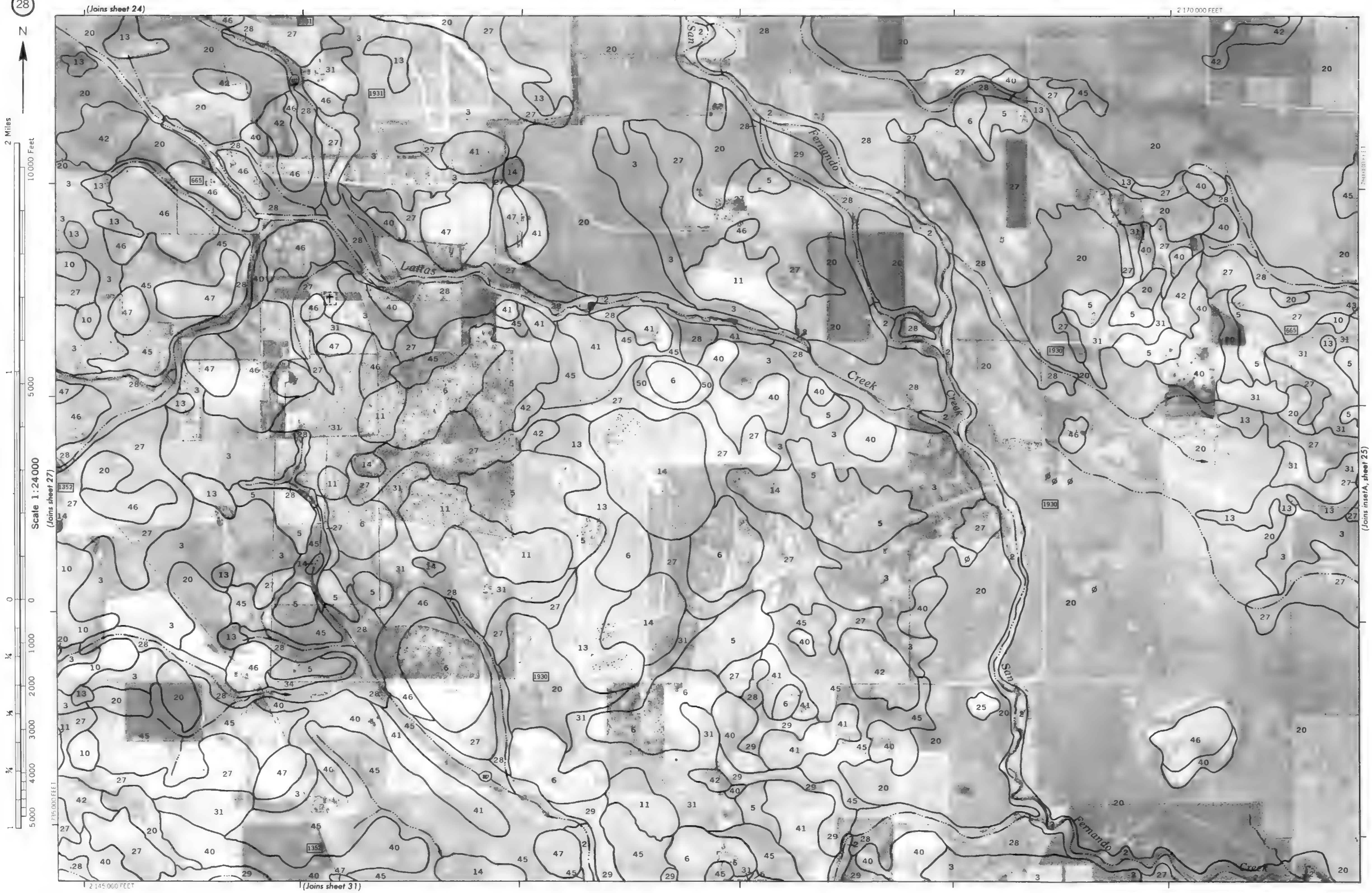


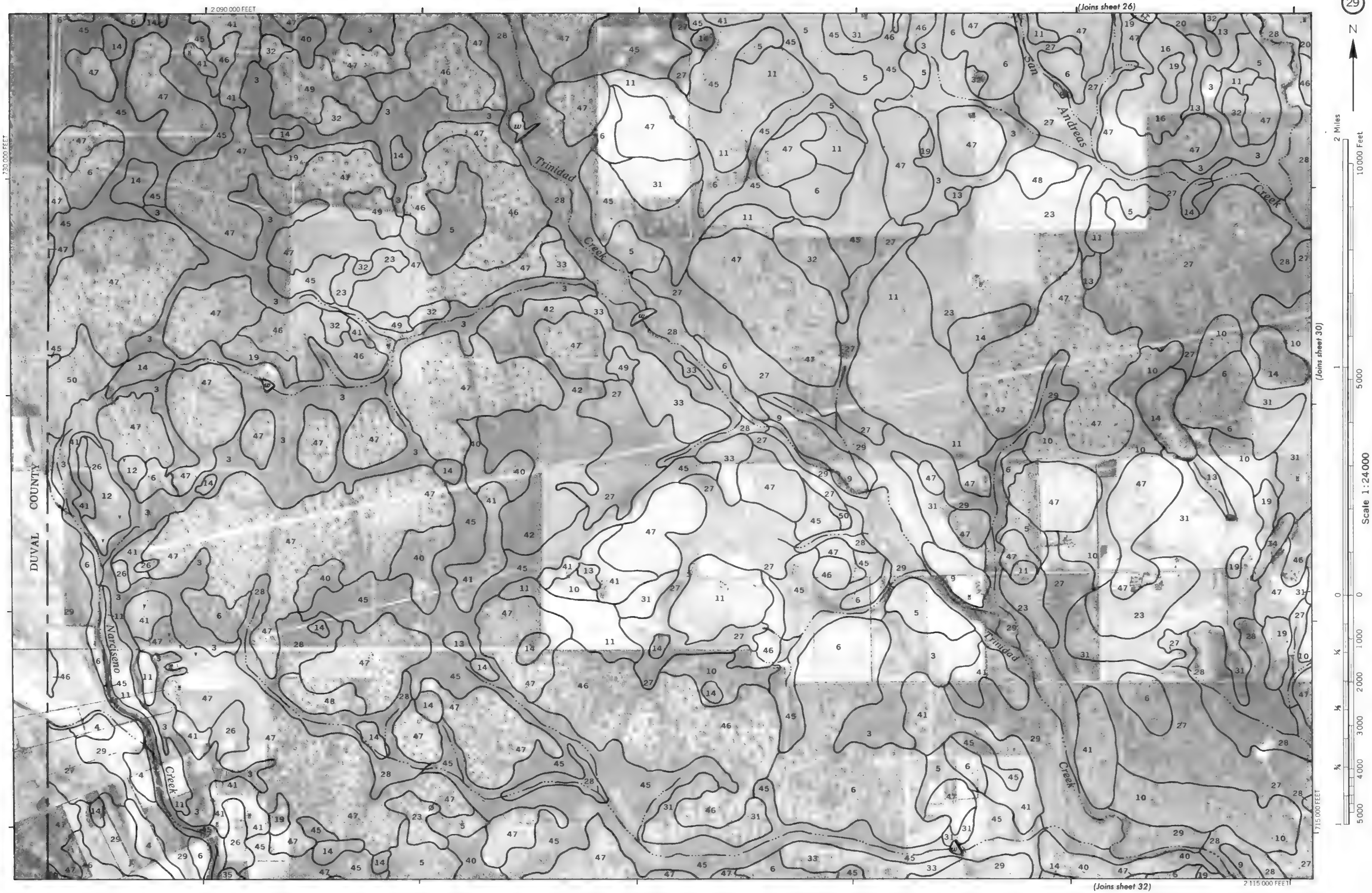


JIM WELLS COUNTY, TEXAS — SHEET NUMBER 26

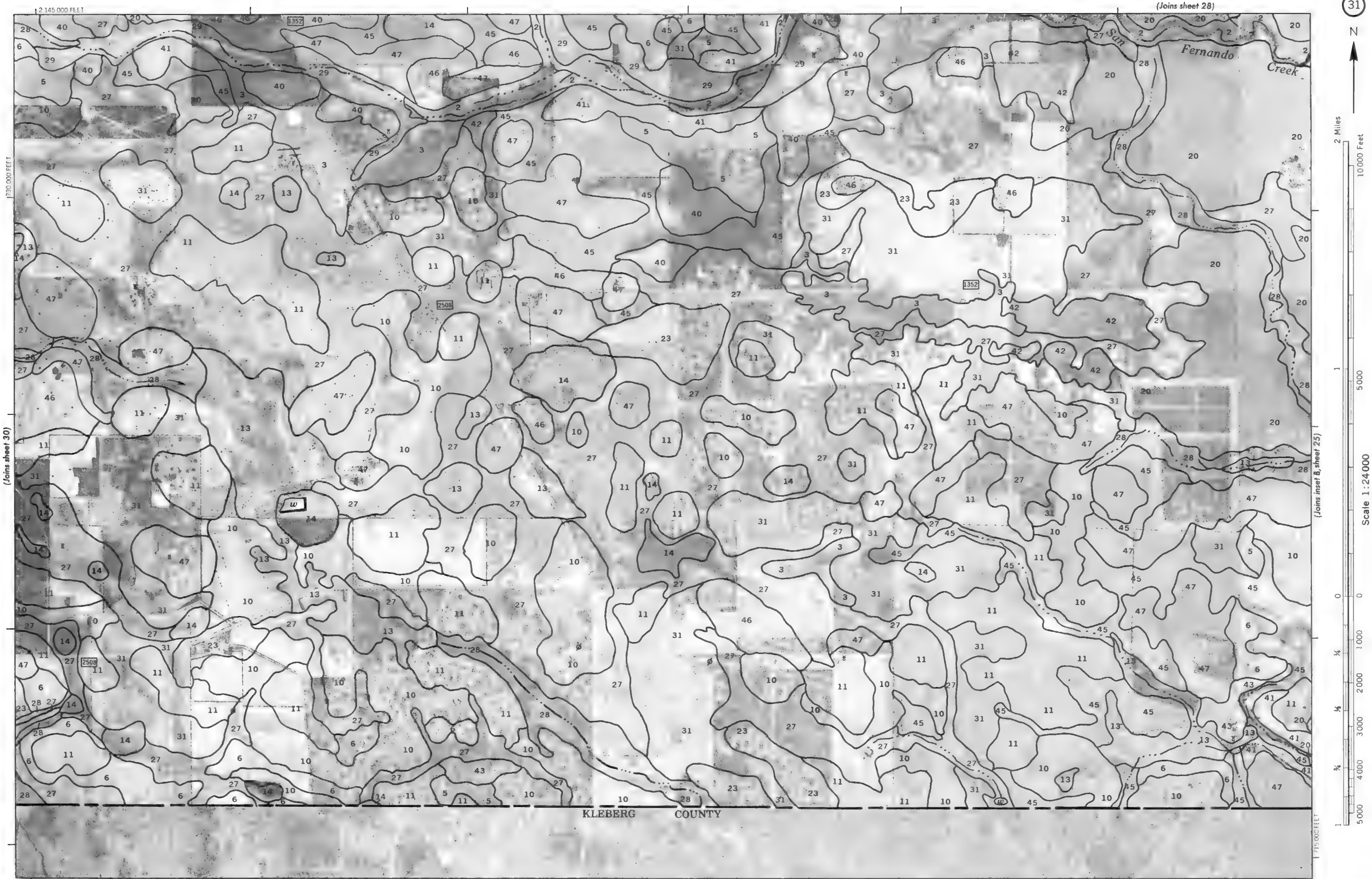


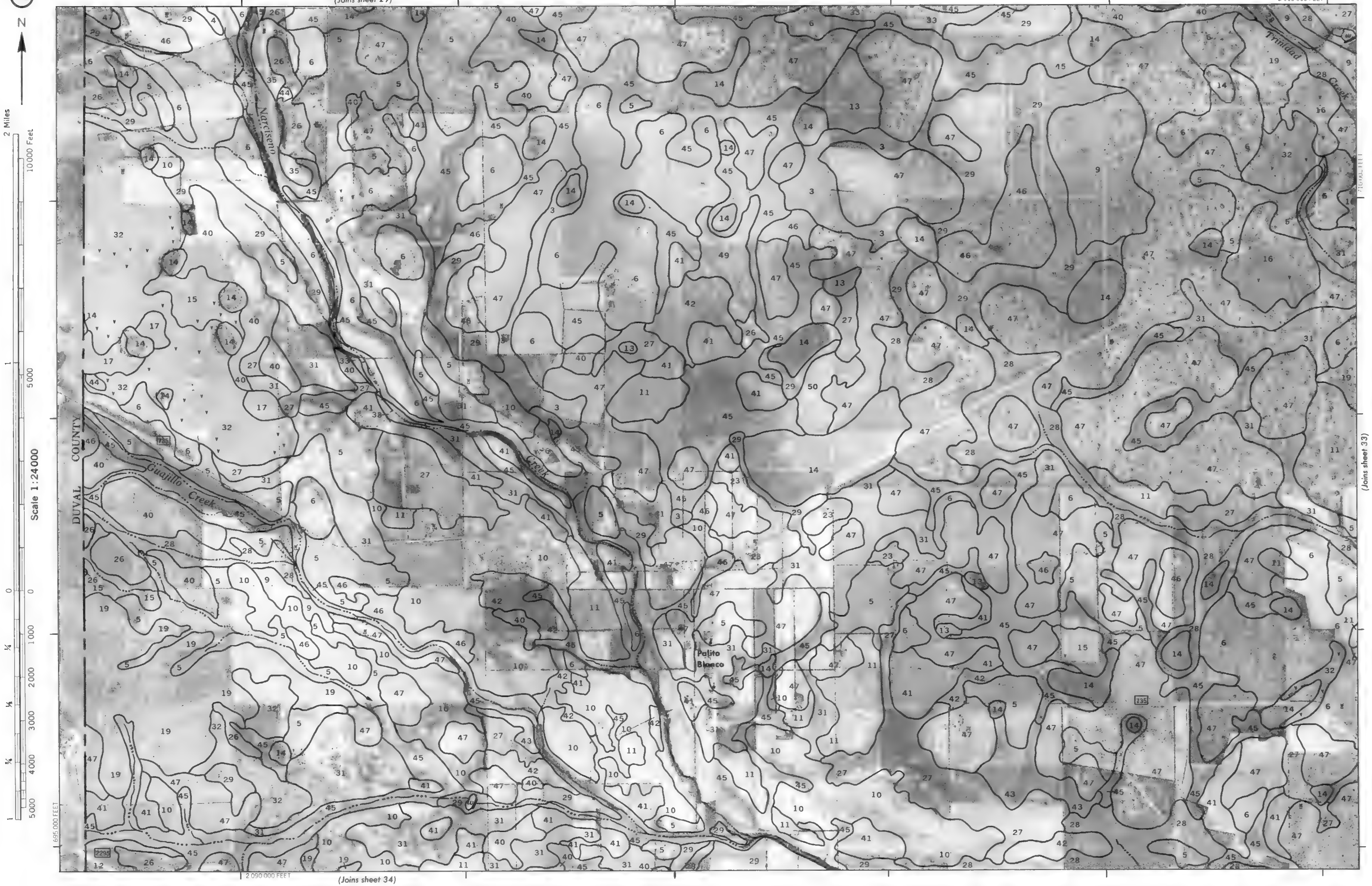

(Joins sheet 23)
ALICE
(county seat)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 30)
SOUTHERN PACIFIC
N
Scale 1:24000
2 Miles
10000 Feet


N
(Joins sheet 24)
(Joins sheet 27)
(Joins sheet 31)
(Joins inset A, sheet 25)
Scale 1:24 000
2 Miles
10 000 Feet
2 170 000 FEET
2 145 000 FEET
Lattas Creek
San Fernando Creek

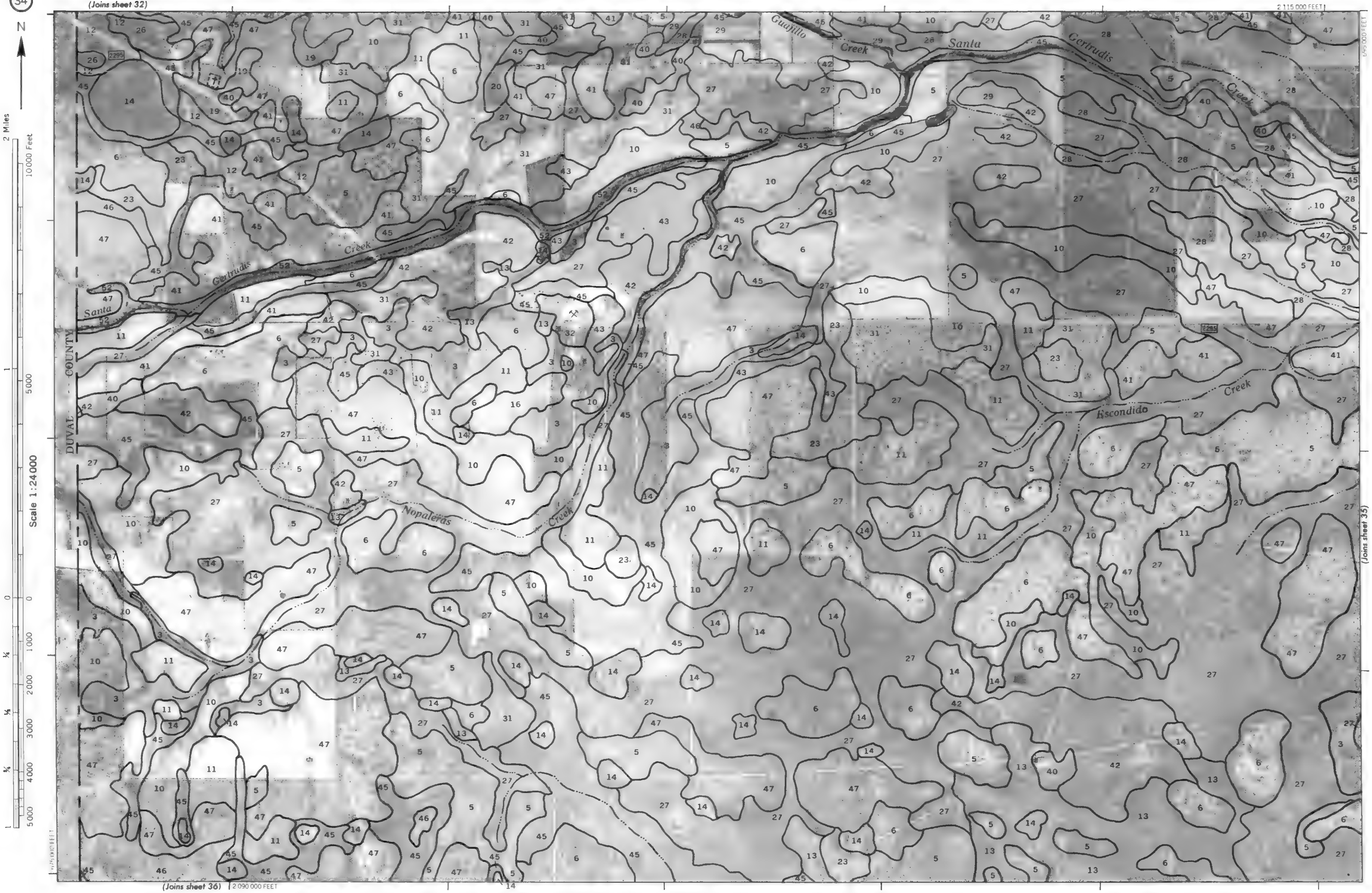

29
N
(Joins sheet 26)
(Joins sheet 30)
(Joins sheet 32)
2 090 000 FEET
2 115 000 FEET
730 000 FEET
715 000 FEET
DUVAL COUNTY
Trinidad Creek
San Andreas Creek
Narciseno Creek
Trinidad Creek
2 Miles
10 000 Feet
Scale 1:24 000


(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 33)
2 140 000 FEET
730 000 FEET
715 000 FEET
2 120 000 FEET
N
Scale 1:24000
2 Miles
10 000 Feet
San Andreas Creek
SOUTHERN PACIFIC
281
2508
Ben Bolt
KLEBERG COUNTY

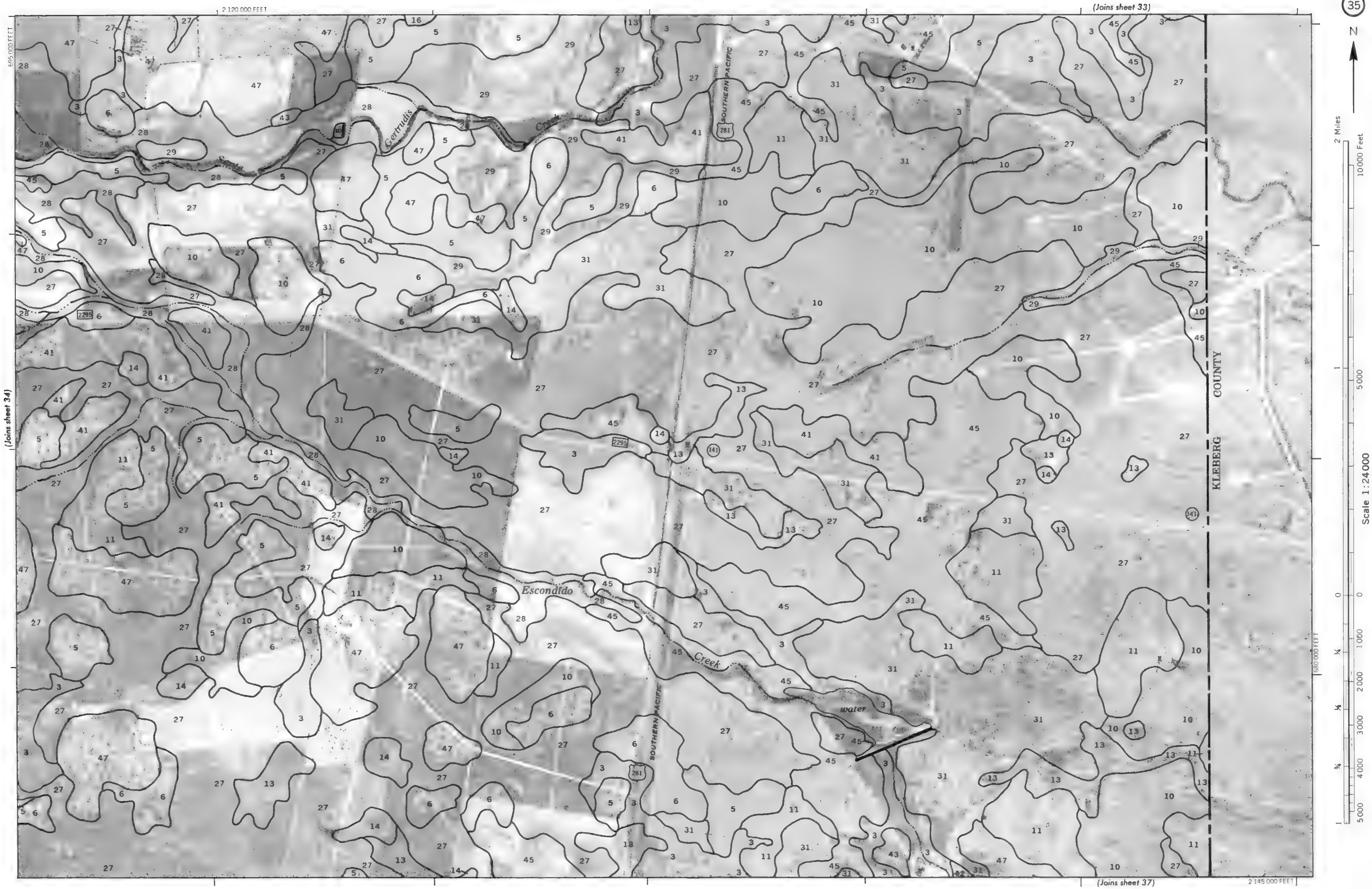

(Joins sheet 28)
(Joins sheet 30)
(Joins inset B, sheet 25)
San Fernando Creek
KLEBERG COUNTY
2 145 000 FEET
2 170 000 FEET
730 000 FEET
715 000 FEET
N
Scale 1:24000
2 Miles
10 000 Feet

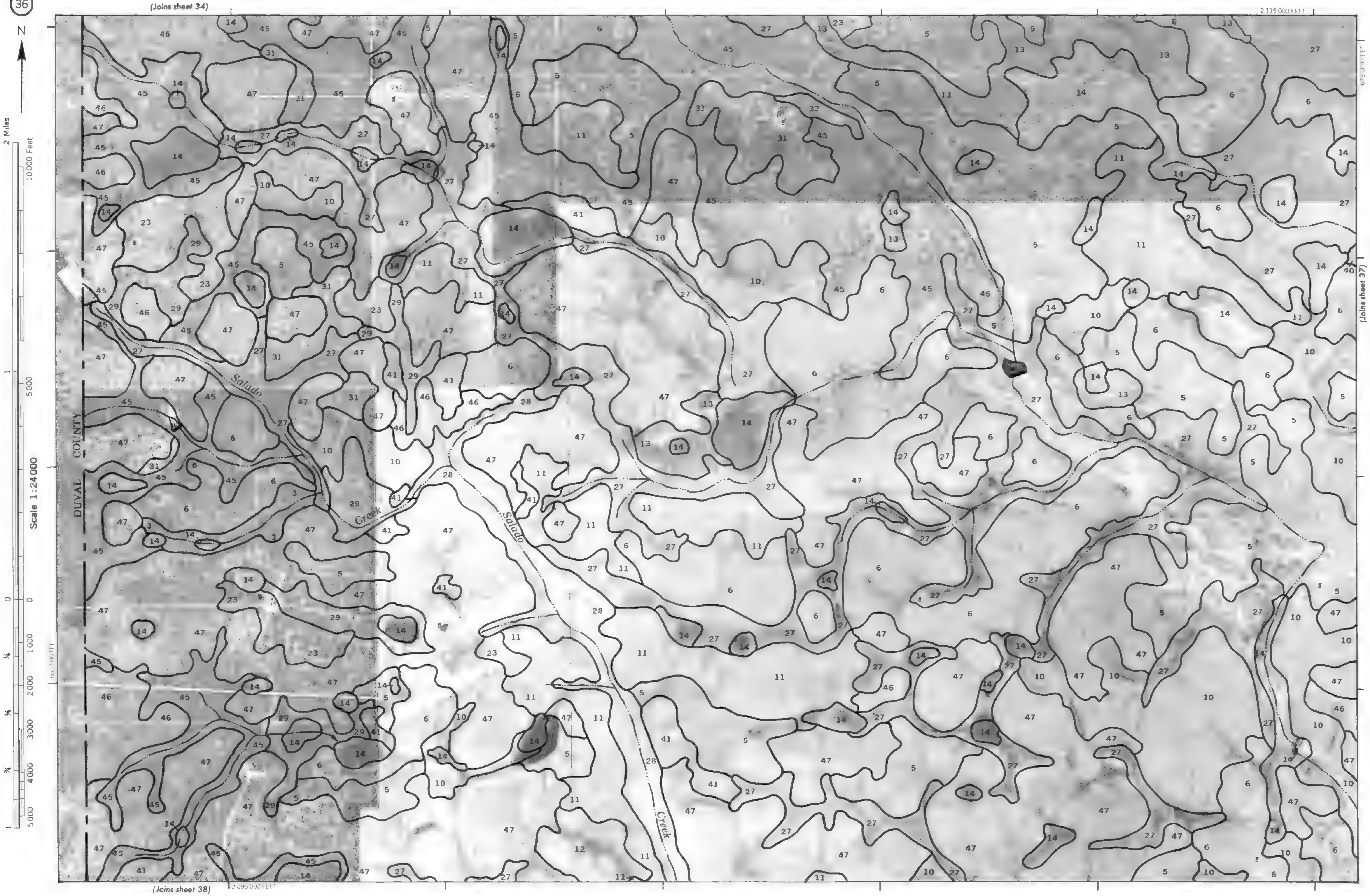

(Joins sheet 29)
(Joins sheet 33)
(Joins sheet 34)
N
2 Miles
10 000 Feet
Scale 1:24000
DUVAL COUNTY
Narciseno
Guajillo Creek
Trinidad Creek
Creek
Palito Blanco
2 115 000 FEET
2 090 000 FEET
695 000 FEET

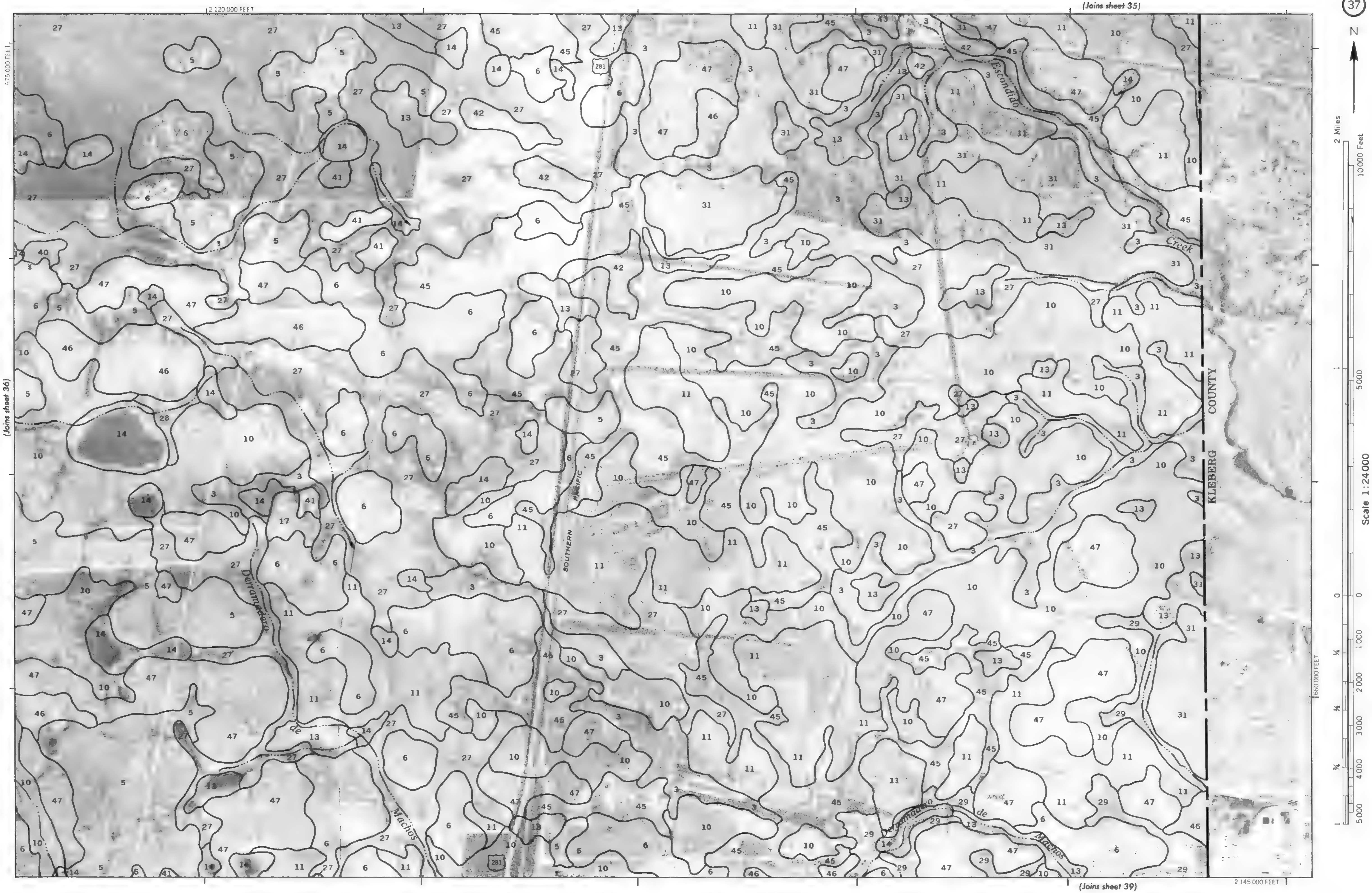

33
N
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 35)
2 120 000 FEET
2 145 000 FEET
Trinidad Creek
San Andreas Creek
Santa Gertrudis Creek
SOUTHERN PACIFIC
KLEBERG COUNTY
water
Scale 1:24000
2 Miles
10 000 Feet

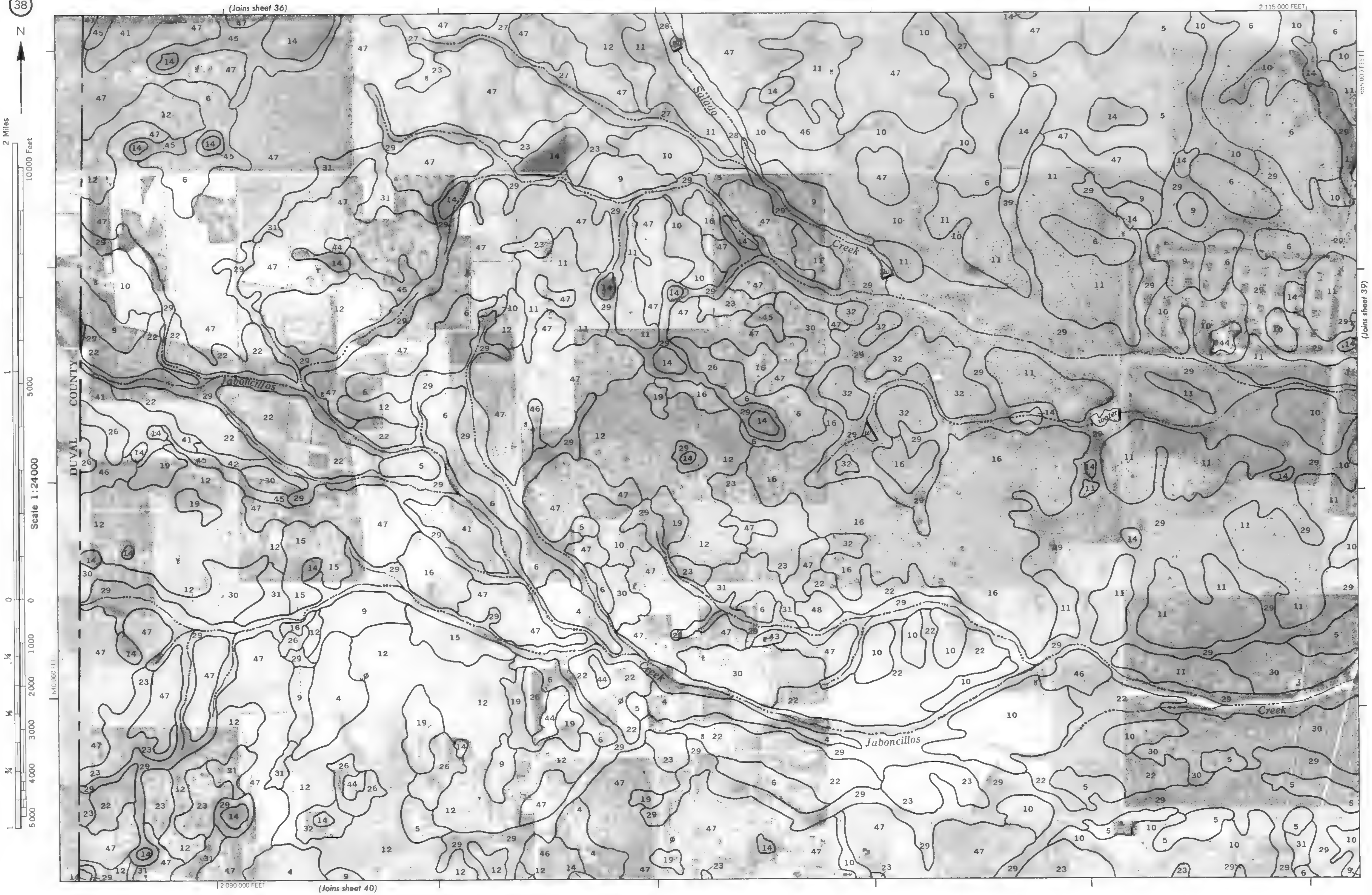

(Joins sheet 32)
(Joins sheet 35)
(Joins sheet 36)
2 115 000 FEET
2 090 000 FEET
N
2 Miles
10000 Feet
5000
0
Scale 1:24 000
DUVAL COUNTY
Santa Gertrudis Creek
Guajillo Creek
Nopaleras Creek
Escondido Creek
2295

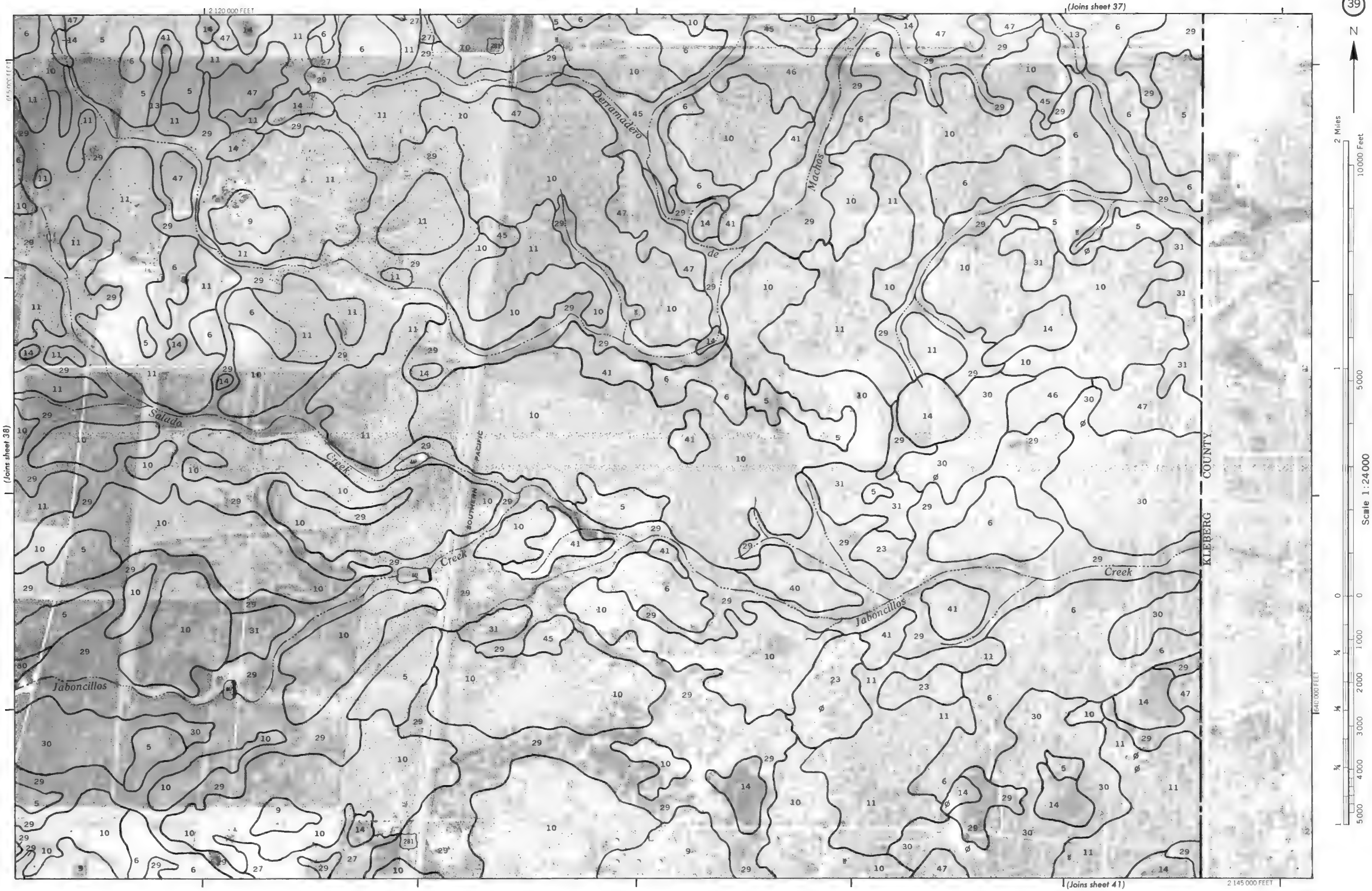
JIM WELLS COUNTY, TEXAS — SHEET NUMBER 35

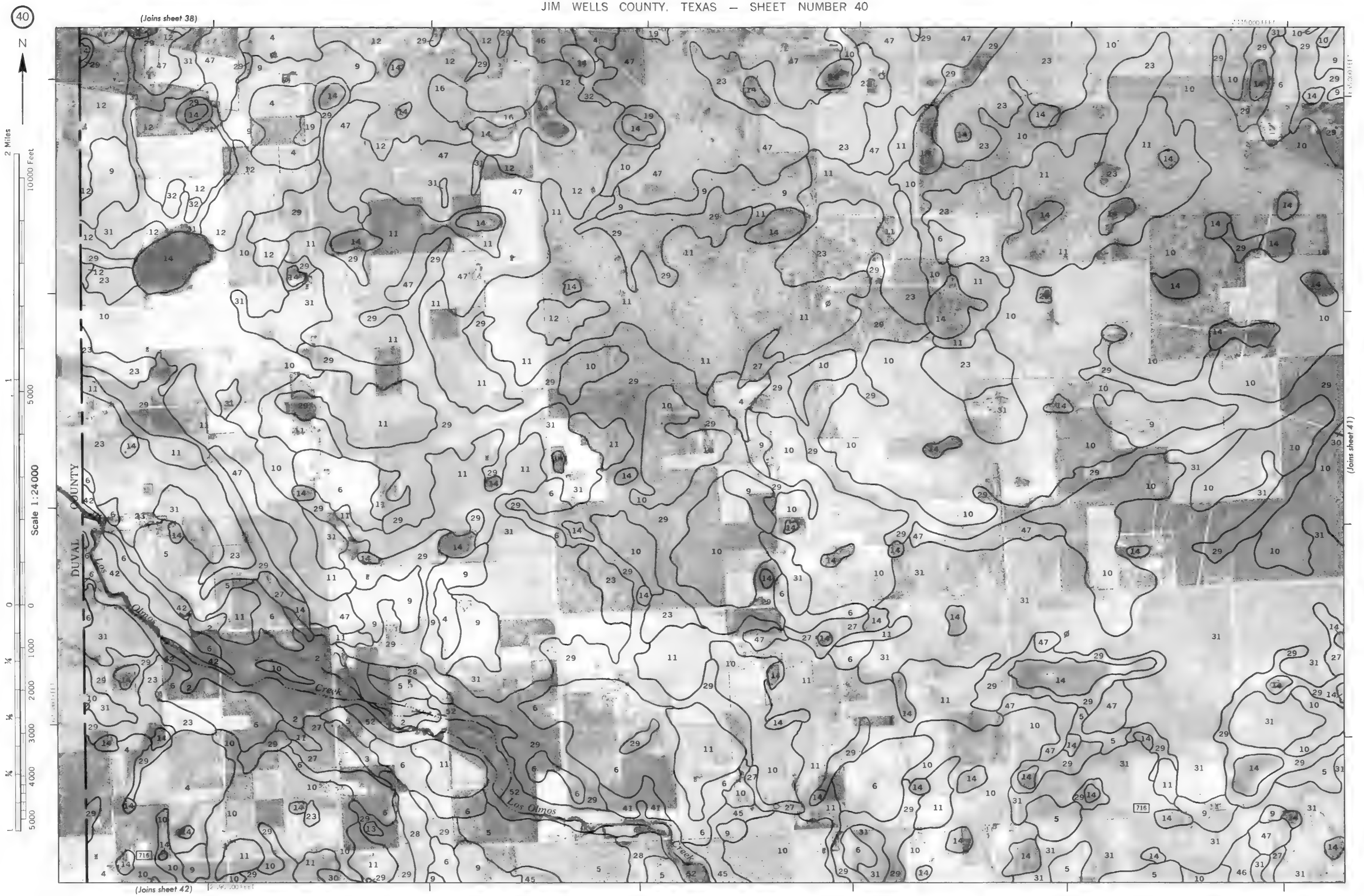



(Joins sheet 34)
(Joins sheet 37)
(Joins sheet 38)
N
2 Miles
10 000 Feet
Scale 1:24 000
DUVAL COUNTY
Salado Creek
Salado Creek
2 115 000 FEET
2 090 000 FEET


37
N
(Joins sheet 35)
(Joins sheet 36)
(Joins sheet 39)
2 120 000 FEET
2 145 000 FEET
660 000 FEET
KLEBERG COUNTY
SOUTHERN PACIFIC
Escondido
Creek
Deramadero
de
Machos
Scale 1:24000
2 Miles
10000 Feet

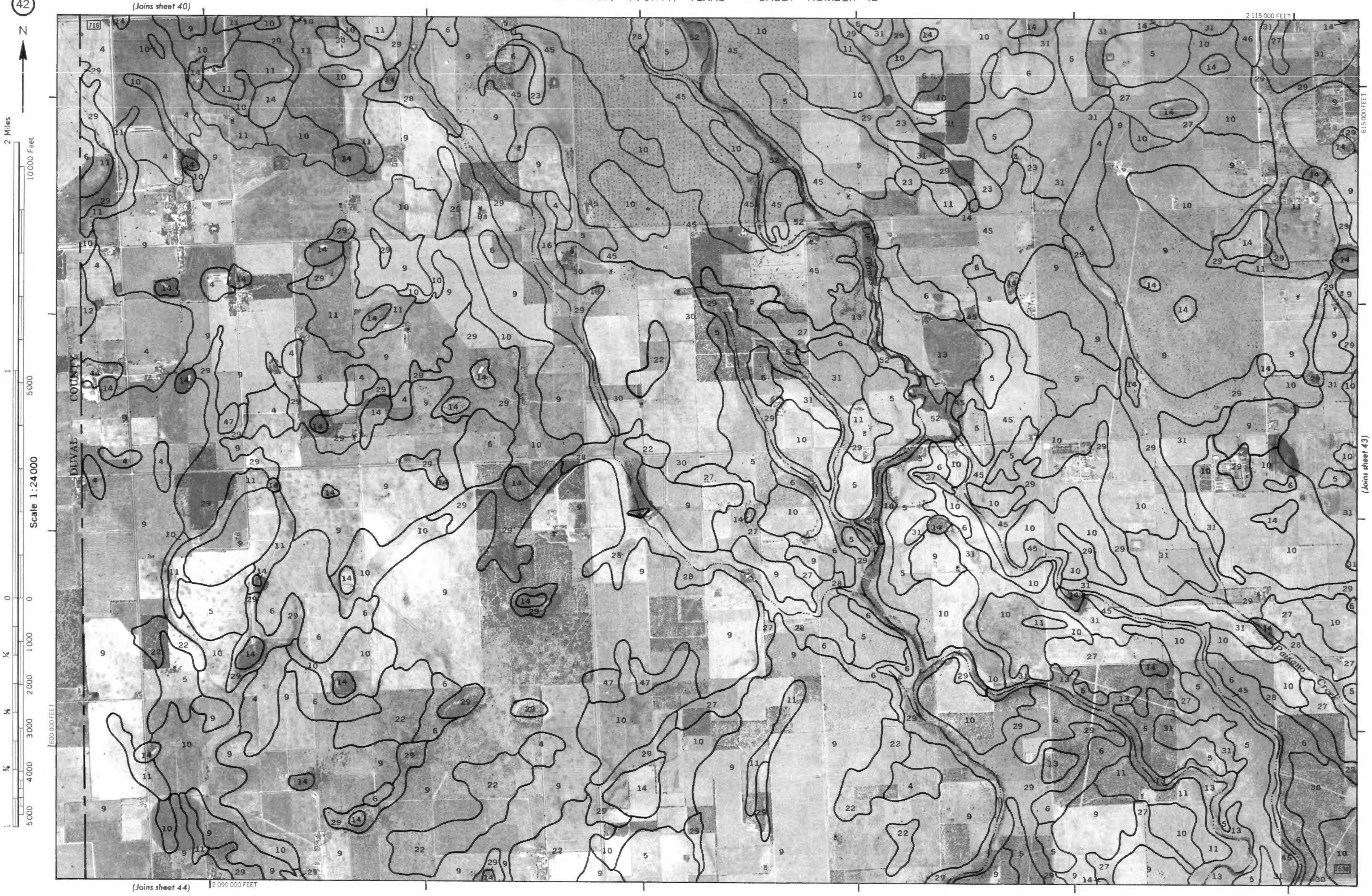

N
(Joins sheet 36)
(Joins sheet 39)
(Joins sheet 40)
2 115 000 FEET
2 090 000 FEET
DUVAL COUNTY
Salado
Creek
Jaboncillos
Creek
Jaboncillos
Creek
water
Scale 1:24 000
2 Miles
10 000 Feet
1
5000
0
0
1000
2000
3000
4000
5000


39
N
(Joins sheet 37)
(Joins sheet 38)
(Joins sheet 41)
2 120 000 FEET
2 145 000 FEET
640 000 FEET
Derramadero
de
Machos
Salado
Creek
Creek
SOUTHERN PACIFIC
Jaboncillos
Creek
Jaboncillos
KLEBERG COUNTY
281
Scale 1:24000
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000


40
N
(Joins sheet 38)
(Joins sheet 41)
(Joins sheet 42)
DUVAL COUNTY
Los Olmos Creek
Los Olmos Creek
Scale 1:24000
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
716
716


(Joins sheet 39)
(Joins sheet 40)
(Joins sheet 43)
2 120 000 FEET
635 000 FEET
2 145 000 FEET
Seeligson
PREMONT
SOUTHERN PACIFIC
KLEBERG COUNTY
281
716
N
2 Miles
10000 Feet
Scale 1:24000

JIM WELLS COUNTY, TEXAS — SHEET NUMBER 42




43
N
2 120 000 FEET
620 000 FEET
(Joins sheet 41)
(Joins sheet 42)
(Joins sheet 59)
PREMONT
SOUTHERN PACIFIC
water
Paisano Creek
Paisano
Creek
KLEBERG COUNTY
605 000 FEET
2 145 000 FEET
2 Miles
1
0
¼
½
¾
10 000 Feet
5000
1000
2000
3000
4000
5000
0
Scale 1:24000

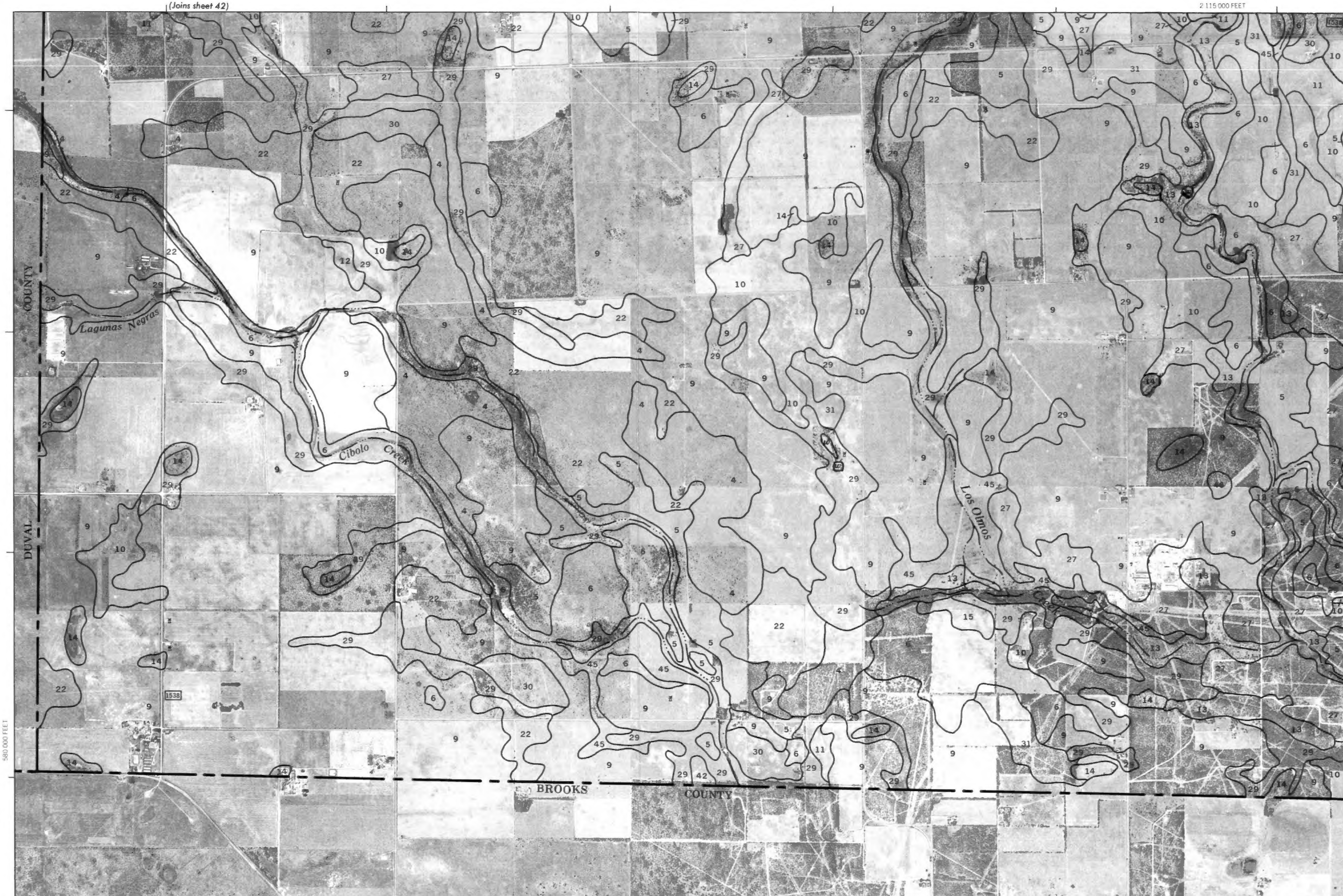
44

JIM WELLS COUNTY, TEXAS — SHEET NUMBER 44

N

2 Miles | 10 000 Feet | 1 | 5000 | 0 | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 1

Scale 1:24 000




45
N
(Joins sheet 43)
(Joins sheet 44)
2 120 000 FEET
595 000 FEET
580 000 FEET
2 145 000 FEET
Paisano
Creek
La Gloria
Los Olmos
Creek
SOUTHERN PACIFIC
281
KLEBERG COUNTY
BROOKS COUNTY
Scale 1:24000
2 Miles
1
¾
½
¼
0
10 000 Feet
5000
4000
3000
2000
1000
0
5000